L AND GAS URNAL

How TIMKEN® bearings take a load off a driller's mind

THIS Emsco Type AE-6 Swivel takes tremendous thrust loads—and gives long, trouble-free performance, thanks to a Timken® Type T flat thrust bearing in the main bearing position.

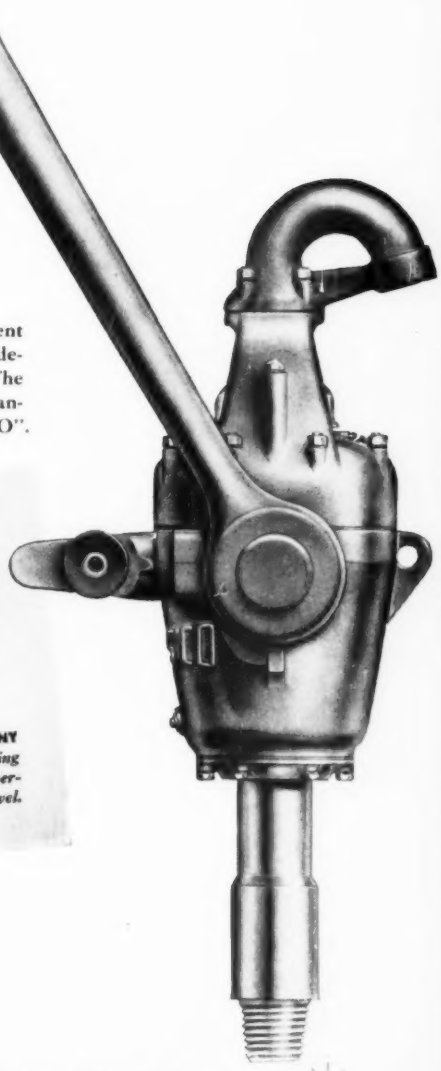
Due to their tapered construction, Timken bearings take both radial and thrust loads in any combination. Line contact between the rolls and races provides extra load-carrying capacity. And because Timken tapered roller bearings are manufactured to extreme limits of precision, friction in the bearing is reduced to a minimum.

The rolls and races of Timken bearings are made of Timken fine alloy steel for toughness and case-hardened to give them maximum wear-resistance. No breaking-in time is required and rig down-time is greatly reduced.

Dependable performance in hundreds of applications have made Timken bearings first choice throughout industry.

Whether you buy oil field equipment or build it, always look for the trademark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, O. Cable address: "TIMROSCO".

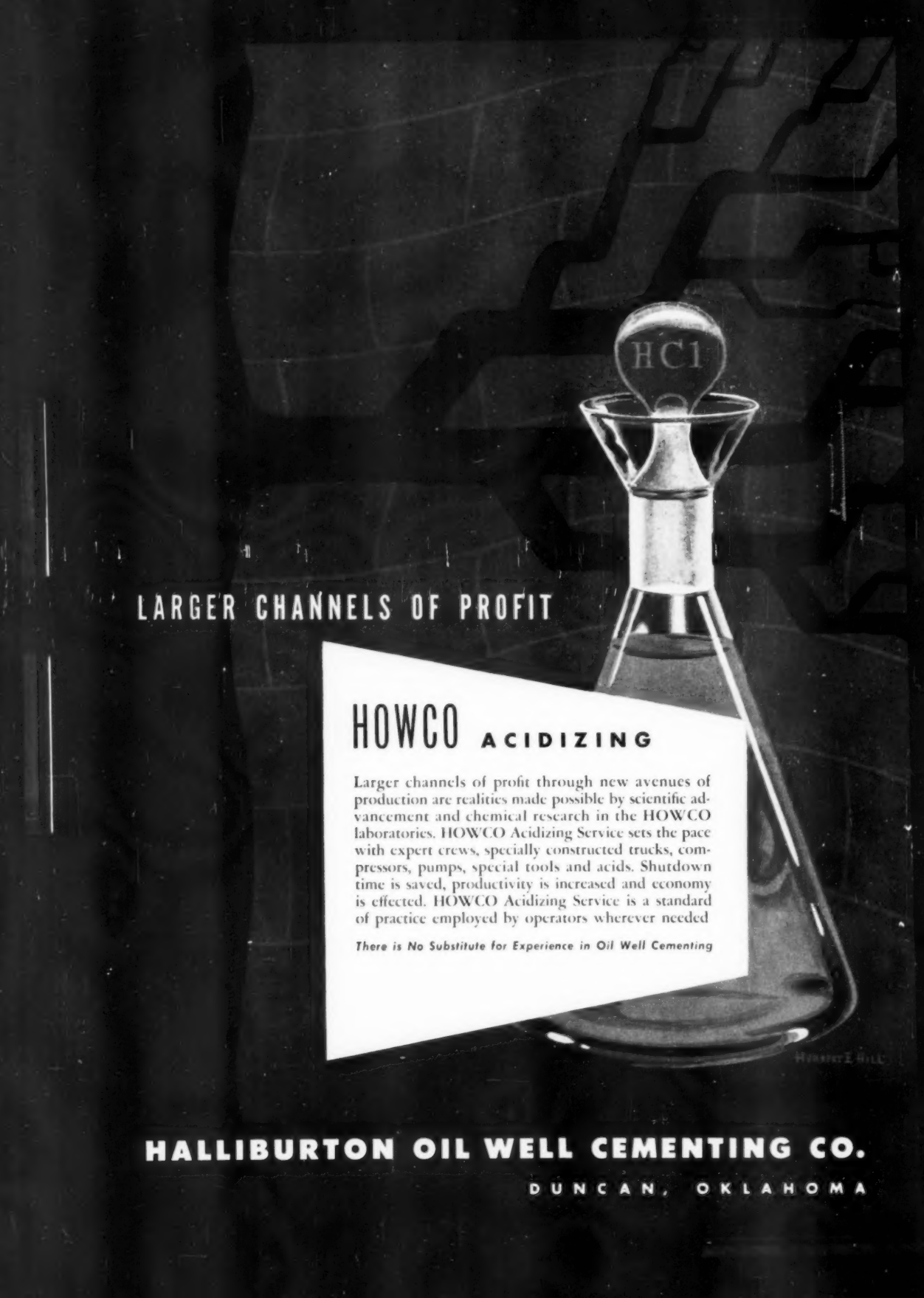
EMSCO DERRICK & EQUIPMENT COMPANY *uses a Timken Type T flat thrust bearing to insure long life and trouble-free performance for this Emsco Type AE-6 Swivel.*



TIMKEN *TAPERED ROLLER BEARINGS*

NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◐ AND THRUST ◐ LOADS OR ANY COMBINATION

PRICE 50 CENTS TABLE OF CONTENTS PAGE 59 **APRIL 27, 1950**


HC1
LARGER CHANNELS OF PROFIT
HOWCO ACIDIZING
Larger channels of profit through new avenues of production are realities made possible by scientific advancement and chemical research in the HOWCO laboratories. HOWCO Acidizing Service sets the pace with expert crews, specially constructed trucks, compressors, pumps, special tools and acids. Shutdown time is saved, productivity is increased and economy is effected. HOWCO Acidizing Service is a standard of practice employed by operators wherever needed
There is No Substitute for Experience in Oil Well Cementing
HALLIBURTON OIL WELL CEMENTING CO.
DUNCAN, OKLAHOMA

ideal for High-Temperature Bolting

because of its BUILT-IN STRENGTH

You can count on long, satisfactory service when you use the Bethlehem Quenched Nut in the high-temperature, high-pressure bolting applications encountered in refineries.

The Bethlehem Quenched Nut is ideal for use in severe bolting applications because of its built-in strength. This nut is no ordinary nut, punched from a hot bar. Instead, it is *hot-forged*—actually formed by forging and extruding hot metal into a forming die. This is followed by quenching and tempering, which produces a nut strong enough to break any stud or bolt on which it is used.

The Bethlehem Quenched Nut has a tough grain structure, and its oxidized sides are resistant to atmospheric corrosion. The nut also has a bearing surface which is far superior to common, machined surfaces.

The Quenched Nut is manufactured at Bethlehem's Lebanon, Pa., plant, and conforms to Grade 2H of ASTM Specification A194. It is carried in stock in bolt sizes from ⅜ in. to 3½ in. Lebanon Plant also stocks nuts in Grades 0, 1, 2, and 4. If you'd like one of our representatives to explain in greater detail the advantages of the Quenched Nut, contact our nearest sales office, or write to us at Bethlehem, Pa.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

Bethlehem supplies every type of Fastening

The Oil and Gas Journal, published Thursdays by The Petroleum Publishing Company. Entered as second-class matter September 1, 1910 at post office at Tulsa, Okla., under act of March 3, 1879. U. S. and foreign rates to the petroleum industry, $3 yearly. Copyright 1950

MOCKING BIRDS

SPECIALISTS IN *Southwest* CONSTRUCTION

Successful industrial construction in the Southwest calls for a loyal organization plus ***Southwest*** experience that can cope with a multitude of ***unique*** problems: soil, climate, terrain.

Over a period of thirty years, Brown & Root, Inc., has surmounted every obstacle presented to Southwestern engineering and construction. This assures "Brown-Bilt" projects today the benefit of specialized techniques — proven engineering and construction processes especially adapted to this locale.

Any organization considering an enterprise in the Southwest would do well to contact Brown & Root, Inc. The wisdom of thirty-years' experience ***could*** prove ***invaluable!***

BROWN & ROOT, Inc. *Engineers & Constructors*

P. O. BOX 3, HOUSTON 1, TEXAS

CABLE ADDRESS — BROWNBILT

BROWN-BILT

Associate Companies — BROWN ENGINEERING CORP. • BROWN & ROOT MARINE OPERATORS INC.

How to INCREASE BOILER RATINGS

with your present furnace and stack

Coppus-Dennis FANMIX Burners Give You More Heat with No Other Major Change in Equipment

Coppus-Dennis **FANMIX** Burners give you *perfect* mechanical mixing of fuel and air *at the burner outlet . . . instantaneous* ignition close to the burner . . . and *complete* combustion *without visible flame* when burning natural gas. No other burner combines these three advantages.

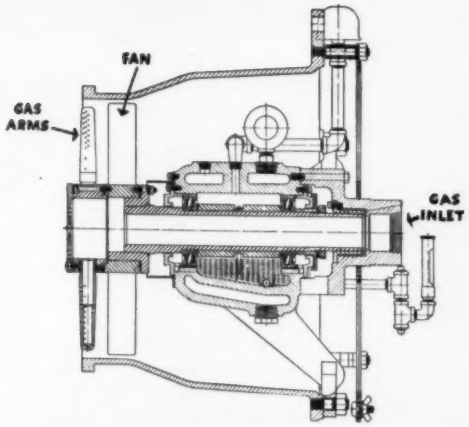
Because **FANMIX** delivers the *right* mixture of fuel and air *without blow-torch action*, all of your furnace space is used for combustion . . . *none for mixing*. That's why your present furnace can release more heat . . . why new installations can get more heat out of smaller furnace space.

Because **FANMIX** can be guaranteed to secure complete combustion of natural gas *with less than 5% excess air*, you get uniform "radiant heat" *without drifting hot spots*. That's why a **FANMIX**-fired furnace seldom varies in temperature more than 5% over its entire area.

WRITE FOR ALL THE FACTS

When you see in Bulletin 410-6 how fuel escaping from orifices in rotating driver arms rotates the fan to draw the correct proportion of air into the path of the fuel at right angles . . . how **FANMIX** creates its own forced draft, reduces stack requirements, prevents cracking of "wet" gas . . . how two **FANMIX** types handle either gas or oil or any combination of both — you'll understand why **FANMIX** Burners have such wide acceptance in oil refineries and power plants.

Send for the Coppus-Dennis **FANMIX** Bulletin 410-6. Coppus Engineering Corporation, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, and REFINERY CATALOG.



ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP.
265 Park Ave., Worcester 2, Mass.
Please send Bulletin 410-6 to:

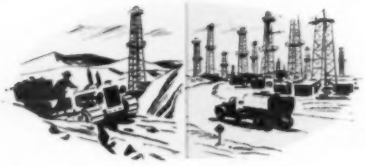
Name .....

Company .....

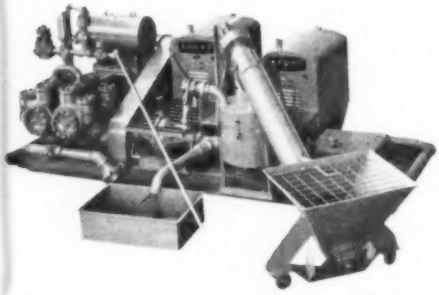
Address .....

ICI engineered equipment

cuts cementing costs on every type of job



Designed to meet the specialized requirements found in overseas fields, ICI Engineered Equipment enables you to do your own cementing and pumping jobs with uniform controlled slurry and at a lower cost. Applicable to any type of cementing work, these ICI units are built in a wide variety of models to meet the requirements of every conceivable job in any terrain under any climatic conditions. Get the facts on these easy-to-operate, easy-to-maintain units today. Write us for the answer to your particular job requirement.



PORTABLE SKID MOUNTED POWER CEMENTING UNIT. Type 500 S combines a 5" x 8" Gardner Denver duplex pump with an ICI 10-blade mixer and fluid drive conveyor. Powered by two Mercury industrial engines — one drives the pump; the other the mixer and conveyor. When specified, skids may be extended and a calibrated water tank with necessary manifolding mounted adjacent to pump.

ICI
Oilfield Equipment

BULK CEMENT BATCH PLANT. Bulk Silos may be installed in any combination of silo units. May include a central, completely automatic, weigh batcher to handle sand, gravel, and admixtures, as well as cement. The batcher speeds up delivery, reduces labor costs, and accurately weighs the quantity and flow of the desired material or combination of materials.

AIR ACTUATED BULK CEMENT UNIT. This outstanding 250 sack bulk cement unit is similar in design to the Model 1250-T. Instead of using the conventional screw conveyor, discharge is air actuated.

TYPE 1250-T. Bulk Cement Unit. A practical 250 sack, 3 axle unit with a gross weight limit of 40,000 lbs. "W" bottomed cement bin equipped with screw conveyor discharge.

INTERNATIONAL CEMENTERS, INC.

6505 Paramount Blvd., Long Beach 5, Calif., NE6-2493, Long Beach 2-1249
Export Office: 420 Lexington Ave., New York, New York, U. S. A.
"T.I.P.S.A." Avenida Roque Saenz, Pena 501, Buenos Aires, Argentina, S. A.

New Answers . . . to Present pH Problems

New Immersion Electrode Assembly uses no sampling line.

New lightweight Flow Electrode Assembly for sampling line measurements.

Two families of controllers for pH applications.

"Controllability Analysis" form for engineering data.

With brand-new developments in pH equipment, plus 26 years experience in pH instrumentation, L&N now has new answers to several important types of industrial pH problems. Furthermore, a unique, time-saving "Controllability Analysis" service quickly and accurately points to the control system which will solve the specific problem.

New developments in equipment cover both the electrodes which sense changes in the pH, and the housings or assemblies which hold the electrodes.

Entirely waterproof construction is featured in the new electrodes. It makes them ideal for humid or wet locations, since they are fully immune to electrical leakage as well as to penetration by process liquids.

One of the new assemblies is an immersion-type unit, to operate in tanks, reactors, etc.; it can even be totally submerged if necessary. It also operates in many places which formerly required a flow-type unit; in such cases it eliminates both the installation and the maintenance of sampling line, pump and accessories. It is made of light, corrosion-resistant plastic.

The other new electrode assembly features convenience and stability where a flow-type unit must be used. Made of plastic, it is light, small, easy to install and thoroughly dependable. Where plastic might not suit, we of course continue to supply assemblies of cast iron and/or Pyrex brand glass.

Two families of recording and controlling instruments are now available: the familiar, accurate and reliable Micromax and the newer but equally dependable Speedomax continuous-balance instrument. Both are available with either electrical or air actuated control systems.

For application engineering simply fill in one of our "Controllability Analysis" forms. Our engineers can then tell how closely pH can be held with either present or proposed plant layout. Let's get together on that pH problem! You will not be obligated; simply write to Leeds & Northrup Co., 4959 Stenton Avenue, Philadelphia 44, Pennsylvania.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl. Ad N-96(6).

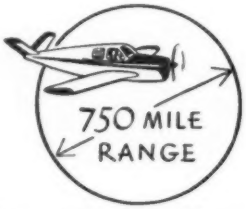
Businesses that grow need the go of a Beechcraft

You make more calls when you cruise at a 170-mile clip. No wasted time, no wasted effort. Travel *means* more! Minutes in the air pay you back with hours of productive time.

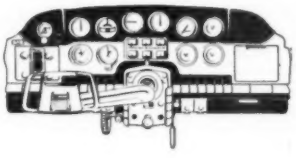
You get to *where* the business is in luxurious comfort. Room to spare for four big people in the smartly tailored, quiet Beechcraft Bonanza cabin. Maximum 5-way visibility.

You travel in safety. The B-35 Beechcraft Bonanza is extra rugged, withstanding shock and stress tests far surpassing CAA requirements. All-metal construction.

You get top performance. Flight characteristics make it exceptionally easy to handle. Speed, range and fuel economy unexcelled! Wide, sturdy landing gear smooths out short, rough-field landings.



You get amazing efficiency. At cruising, the Beechcraft Bonanza uses only 56% of the engine's rated take-off horsepower! And fuel consumption is low—amounting to only 9.5 gallons per hour!



You enjoy many extra features. For instance, a functionally designed instrument panel, highly efficient . . . but handsome, too! Touches of luxurious comfort everywhere—even to coat hangers, ash trays, map pockets!

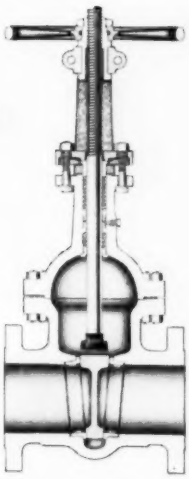
Get all the facts! There are hundreds more . . . about the extra advantages of the new Model B-35 Beechcraft Bonanza. Check with your nearest Beechcraft distributor or dealer, or write for complete information on your company letterhead to Beech Aircraft Corporation, Wichita, Kansas, U.S.A.

Top speed, 184 mph
Cruising speed, 170 mph
Range, 750 miles
Fuel economy, 9.5 gph

Beechcraft BONANZA

BEECHCRAFTS ARE THE AIR FLEET OF AMERICAN BUSINESS

For complete selection...Better service ...Get everything from CRANE



No. 33X, 300-Pound Steel Gate. For oil and oil vapor up to 1100° F. Exelloy to Exelloy seating. Sizes: 1½ to 24 inches.

STEEL VALVES FOR LONG SERVICE...EASY OPERATION

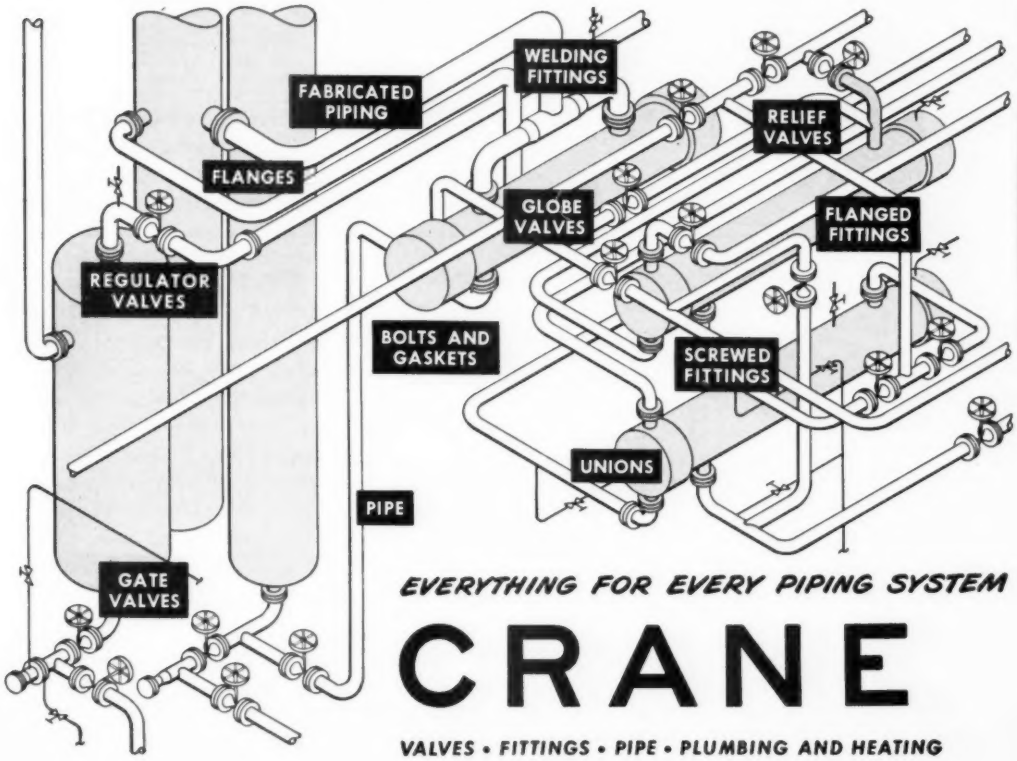
No matter how tough or how precise your service requirements... Crane Cast Steel Wedge Gates will meet them. Crane Quality construction assures highest resistance to pipe line strains, pressure variations, and extreme changes in temperature.

These valves are as easy to operate as they are to keep at peak efficiency. Closely-guided solid wedge disc seats accurately and smoothly; prevents drag and wear on seating surfaces. Side strain on stem is eliminated by Crane flexible T-head and disc-stem connection. Ball-type gland maintains even pressure on packing, avoids binding on stem.

Choose Crane Cast Steel Gates for dependable service. Regularly available in pressure classes up to 1500 pounds, for temperatures up to 1100° F. See your No. 49 Crane Catalog.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

ONE ORDER TO CRANE EQUIPS THIS VAPOR RECOVERY PROCESS UNIT, FOR EXAMPLE

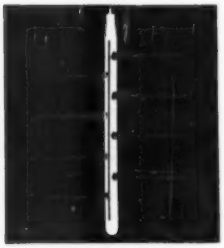


EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

IMPORTANT NEW DEVELOPMENT IN JET PERFORATING



BYRON JACKSON CO., WELEX JET SERVICES, INC., and E. I. du PONT de NEMOURS & COMPANY—originators of jet perforating for oil wells—have combined their engineering, experimental and testing resources to produce a vital new advancement in jet technique . . . a new, more powerful jet force that provides greater penetrating power and produces larger, cleaner holes through multiple strings of casing and into the producible formation.

This new development involves no change in present operating methods or equipment, and is available now in all oil territories through BJ Perfo-Jet Service, Welex Jet Services, Inc. and the following Byron Jackson Co. licensees:

DOWELL INCORPORATED
INTERNATIONAL CEMENTERS, INC.
LANE-WELLS COMPANY
PERFORATING GUNS ATLAS CORPORATION
SPARTAN TOOL & SERVICE CO.
THE WESTERN COMPANY

Byron Jackson Co.
Since 1872
Los Angeles 54, California

Before you buy

a diesel engine

...be sure and read this booklet!

A sound basis of comparison is essential to the selection of the proper diesel engine to meet your power requirements. And that's just what the booklet *"10 Questions to Ask a Diesel Engine Salesman"* gives you. If you want economy, dependability and long engine life this booklet will show you what to look for in a diesel engine.

In addition, the *"10 Questions"* booklet describes fully the Murphy Diesel line of heavy duty "true" diesel engines, giving design details and basic specifications. No diesel power user or prospective diesel power user should be without this helpful 28-page booklet. Write for your copy, mentioning your company affiliation and position.

MURPHY DIESEL COMPANY

5305 W. Burnham St., Milwaukee 14, Wisconsin

OIL INDUSTRY FACTORY BRANCH — Sales, Parts and Service:
113-117 S. Elwood St., Tulsa, Oklahoma
Dealers in principal oil industry centers

Heavy duty power
for the oilfields

Murphy Diesel Engines and Power Units for drilling and pipe line pumping, 90 to 220 H.P. Generator Sets 60 to 133 K.W.

ACCURACY

–another reason for Totco on your rig

What you're after is perfect angle indication... reading after reading with absolute accuracy.

Here's one of the many reasons for TOTCO accuracy–design of the angle indicator. Like a pendulum, TOTCO uses one point suspension. The indicator is balanced on a single fine point. There's little possibility of mechanical failure–no chance at all for repeated false readings.

Because of TOTCO's exclusive design the indicator comes to complete rest in less than ten seconds–perfectly poised for accurate readings. When the instrument records, the indicator point punches an easily read hole in the true-centered chart. The continuity of TOTCO readings is your accurate proof of drilling efficiency.

Be SURE you know are TOTCO

AND YOU CAN TAKE TOTCO READINGS ANYTIME

Run in and out on measuring line.

Dropped down drill pipe; picked up with core barrel overshot.

Dropped down drill pipe; recovered when bit is changed.

Run in the Recorder connected to a core barrel overshot when picking up a retractable core barrel.

Run in and out on ordinary sand line.

You'll get *straighter holes* with a TOTCO Recorder and consistent readings to 1/8 of a degree... accurate, dependable drilling information worth big dollars to you in time and equipment savings. 23 field engineers plus the facilities of 71 Supply Stores are on call to help you drill faster, straighter holes. For accuracy, dependability, and complete service... call TOTCO.

TOTCO Recorder

Technical Oil Tool Corp., Ltd.

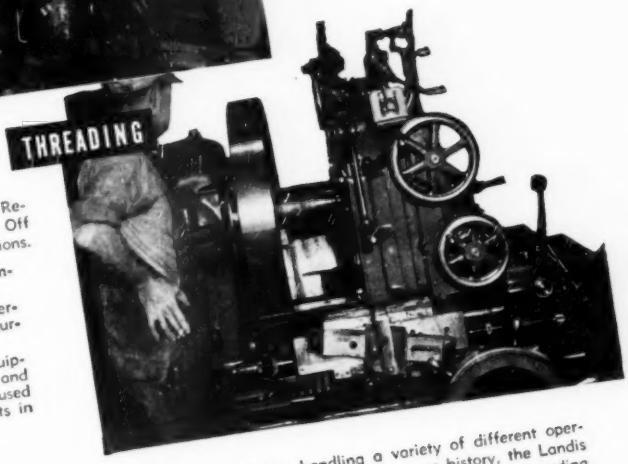
1057 N. La Brea Ave., Los Angeles 38, Calif.

Exclusive Distributors:

California—The Republic Supply Company of Calif.
Domestic—The Continental Supply Company
Canada—Oil Well Supply Company
Export—Lucey Export Corporation, New York City

More Jobs Per Dollar Invested

LANDIS PIPE MACHINES do many operations for this Texas Company...



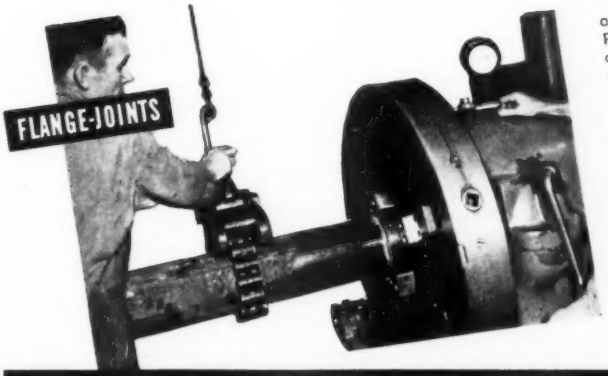
. . . . . saving handling, saving labor, saving machines . . . resulting in dollars saved and dollars earned for this production plant.

Illustrations show the **same** 13⅜" Landis Receding Chaser Pipe Threading and Cutting Off Machine performing three **different** operations.

CUTTING OFF—Casing is cut off, chamfered and then reamed.

THREADING—7" casing to A.P.I. tolerances, using a cutting speed of 18 surface feet per minute.

FLANGE MAKE-UP—Rear chuck is equipped with grip for making up joints and both the front and rear chucks are used for breaking casing or drill pipe joints in oil field work.



Besides handling a variety of different operations, as shown in this case history, the Landis Pipe Machines offer great versatility in threading operations alone. Each size machine handles a wide range of thread diameters. Within this range, and using the same set of chasers, the machine will cut threads of all diameters having the same taper, pitch and form. In addition, these machines are designed to cut tapered threads to precision tolerances. Accurate taper is assured by the sine bar feature, which causes the chasers to be withdrawn at a rate directly equal to the thread being produced.

Landis Pipe Threading Equipment can widen the gap between costs and selling prices in your plant. For complete details and specifications of Landis Pipe Threading Machines and Landis Tangential Chasers, write for Bulletin #C-77.

LANDIS *Machine* COMPANY · WAYNESBORO PENNSYLVANIA

Represented in the Domestic Oil Fields by: Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; C. J. Harter Machinery, Houston, Texas; Frederic-Baker Co., New Orleans, La.; Moore Machinery Co., Los Angeles and San Francisco, Calif.; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.

Standardize AND Save WITH "Caterpillar" Oilfield Hands

Three "Caterpillar" Diesel D13000 Engines power an Emsco GA550 draw works and Gardner-Denver mud pump at the Arrow Drilling Company's rig No. 19, drilling Wesley No. 5 for Midcontinent Petroleum Co. near Ardmore, Oklahoma. The derrick is a Lee C. Moore 127-ft. jack-leg type. Hole will be completed at 4200 ft. Drilling time—10 to 14 days.

Working since 1937, this "Caterpillar" Diesel D4400 Engine powers an OCS pumping unit for the Shell Union Oil Co., Inc., on the Reynolds lease near Sulphur Bluffs, Texas. Production averages 800 barrels of crude oil per day. Gang pusher E. M. Moore, speaking about the D4400s on this lease, says: "The biggest thing about them is they run all the time. I've had less trouble with these 'Cats' than with any engine I've seen. I estimate each of them has run 80,000 hours."

No matter what or where your job is—exploration, drilling, pumping, servicing or pipelining—you'll find it pays to standardize on "Caterpillar" Diesels. These Big Yellow Engines and Machines are tough oilfield hands. Ruggedness is built into every inch of them for trouble-free operation. They're engineered for steady power, so you don't have to tinker with them. And with one manufacturer responsible for the whole crew—and your nearby "Caterpillar" dealer well-equipped with parts and know-how—you can count on fast, efficient service 'round the clock.

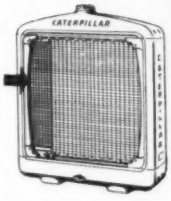
Here's another fact worth noting. Every "Caterpillar" Diesel Engine delivers horsepower as advertised. Specify them when you order your rigs, pumps, ditchers, shovels, air compressors, welders, marine equipment and other machinery—and you can be sure the rated power is all there. There is also a complete line of "Caterpillar" Diesel Electric Sets with a selection of voltages to match your job, as well as Tractors, 'Dozers and Earthmoving Equipment that can't be beat for money-saving performance. Get a line on them today from your "Caterpillar" dealer!

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

One of 15 "Caterpillar" units on the job, this D7 Tractor with Trackson Pipelayer uses a cable swing to "set in" pipe near Bastrop, La., for the Tennessee Gas Transmission Co., Houston, Texas. Master mechanic E. B. Whitten says: "A lack of immediate parts service can cripple the whole pipe-line team . . . *all* our equipment must stay on the ball *all* the time. Our 'Caterpillar' dealer has one of the most efficient parts departments I've seen."

LOOK UNDER THE HIDE

Lubricating oils break down at high temperatures, forming carbons, lacquers and gums —enemies of long engine life. To prevent lube oil breakdown, "Caterpillar" Engines are equipped with oil coolers. Pistons are oil sprayed to remove heat. Controlled oil temperature preserves lubricating qualities, reduces maintenance costs, adds to owner profits. *Look under the hide for quality.*



Two "Caterpillar" Diesel D318 Electric Sets drive 2 stirrers, mud mixer, 2 water pumps, steamer, shale shaker, blowout preventer compressor, air compressor, blower, lights and dynamatic brake at Cusseta Wildcat, Cass County, Texas. Driller E. D. Wolcott reports: "They're no trouble at all. They handle loads and load changes without special attention."

CATERPILLAR

REG. U. S. PAT. OFF.

OILFIELD ENGINES

CATERPILLAR TRACTOR CO.
BOX OG-4, PEORIA, ILLINOIS

Send me, without obligation, booklet, "Oilfield Hands."

Name _____

Address _____

_____

fill 'er up!

Sonny's relying on the gas station man just like Dad. But just like so many grown-ups he doesn't stop to think what an amazingly complicated production job winds up at the corner gas pump. But we at Wheatland make it our business to study the complex problems of the petroleum industry and then to produce the best steel pipe we know how to make. Untold miles of it are giving satisfactory service.

-pipe with the yearmark!

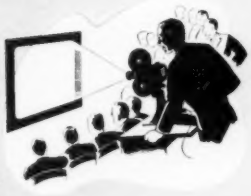
WHEATLAND TUBE COMPANY

BANKERS SECURITIES BUILDING · JUNIPER AND WALNUT STREETS · PHILADELPHIA 7, PA.

3 WAYS

Jones Helps Improve Sucker Rod Service

1



VISUAL INSTRUCTION. A new sound motion picture has proved a real time and money saver for instructing rod crews, supplier's men and others in correct care and handling of sucker rods. Group showings are arranged upon request.

2

INFORMATIVE LITERATURE. To satisfy the demand for printed information, Jones supplies booklets, folders, catalogs and other material. These are prepared to offer pertinent facts in convenient form. They are useful in the field and help expedite specifying and ordering.

3

FIELD ENGINEERING SERVICE. Constructive suggestions and recommendations of this service provide definite production improvements. Based on the technical skill of experienced field engineers, using precision equipment, it provides a scientific analysis of pumping conditions that result in more production at lower cost.

THE S. M. JONES COMPANY

(Subsidiary of Buffalo Bolt Company)

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Sales Office: Kennedy Building, Tulsa, Okla.

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Call Avondale!

Tomorrow, the next day — who knows when? You may suddenly have need for expert repair or construction. In such case, call experts — call AVONDALE . . . all types of marine work for the oil industry.

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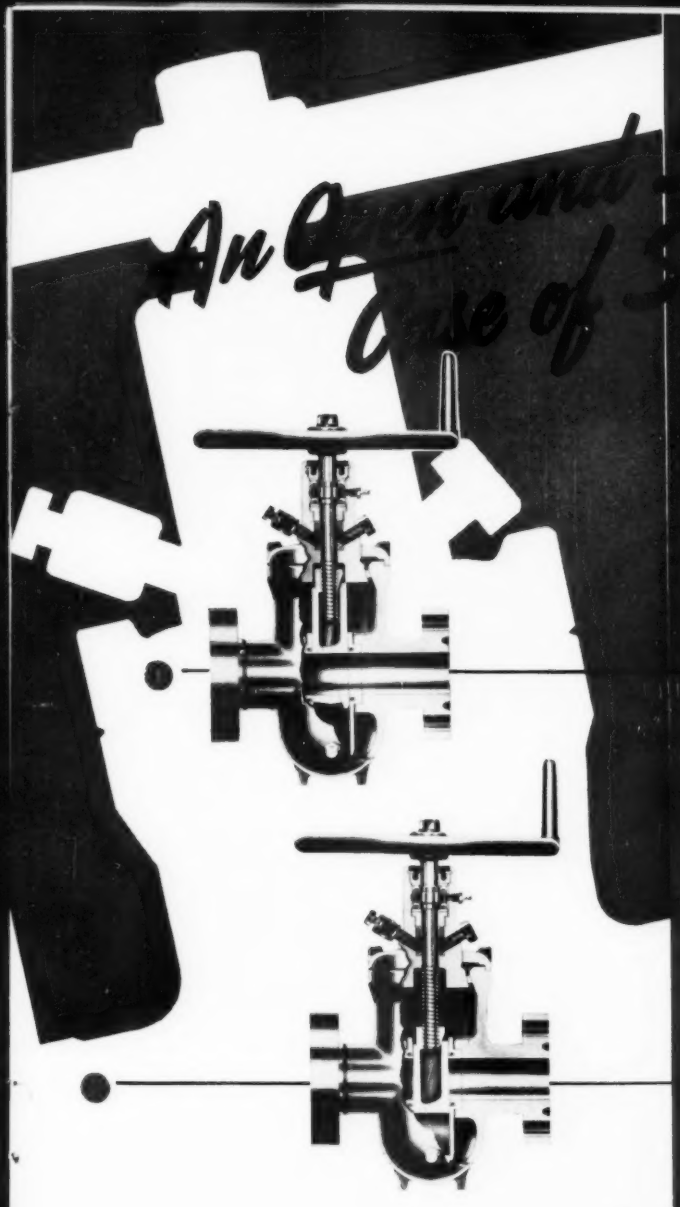


W-K-M GATE VALVES

In the long run W-K-M Valves have proved their case for superiority in the oil industry. Over 80% of all the World's high pressure wells are equipped with W-K-M Valves.

OPEN

CLOSED

W-K-M SUPERIOR DESIGN INCLUDES THESE ADDITIONAL FEATURES

- [illegible] gate clear . . . guiding [illegible] seat [illegible] guiding in.
- [illegible] gland or gland follower.
- [illegible] special lubricant required . . . and does not depend on lubricant.
- [illegible]

W-K-M Company

OIL FIELD, PIPE LINE & INDUSTRIAL EQUIPMENT

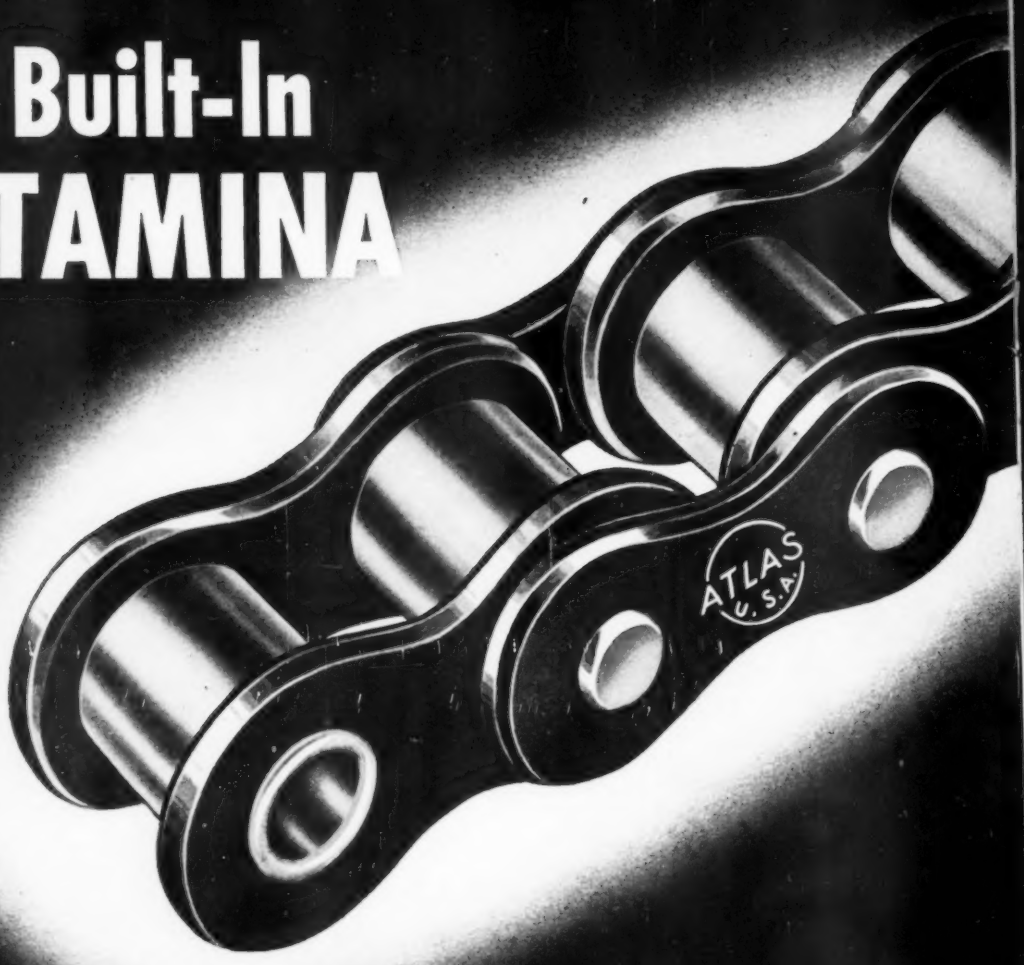
HOUSTON, TEXAS, U. S. A.

LOS ANGELES

Cable Address: "WILKOMAC"

Export Office: 30 Rockefeller Plaza, New York, N. Y.

Built-In STAMINA



. . . ANOTHER REASON FOR THE "SUPER-LIFE" OF ATLAS CHAIN

Every component in a link of roller chain plays an important part—the bushing, the pin, the link and inside plate, the roller. Each must pull its share of the load—each must be heat-treated so that it takes more than its share of the punishment. Otherwise, premature chain maintenance and replacement.

The Atlas Nicarb Process used for case hardening bushings and pins is one big reason for the stamina of Atlas "Super-Life" Chain. Nicarbing provides an outer surface strongly bound to the core of the steel which provides greater strength and wear resistance.

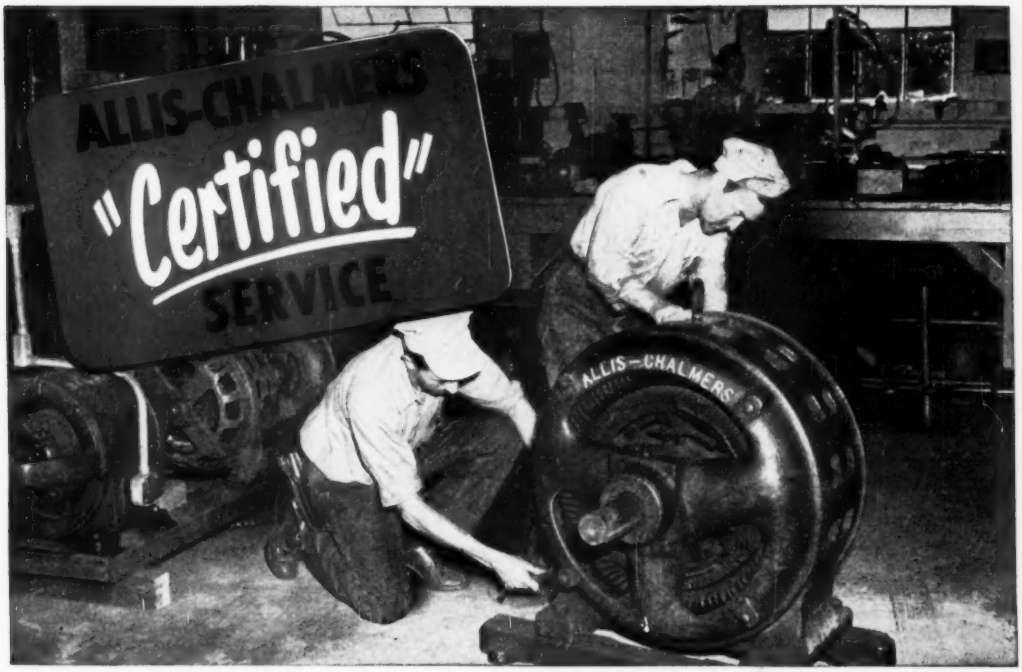
The link plates and rollers are also made of tough, heat-treated alloy steel; their uniformity achieved with automatic electronic instruments which control the furnaces.

Yes, every component part of Atlas "Super-Life" Chain is made to have the maximum of inherent strength. This means greater efficiency—greater economy—on every drive!

Investigate today the chain that keeps on running after ordinary chain is out of service. Write: ATLAS CHAIN and MANUFACTURING COMPANY, Kensington & Castor Avenues, Philadelphia 24, Penna.

"SUPER-LIFE"

ATLAS CHAIN



HERE'S MOTOR REPAIR SERVICE

THAT WILL SAVE YOU MONEY!

A-C Certified Service Shops, like Cincinnati Electric Equipment Company shown, have modern equipment and expert personnel for fast emergency service . . . for routine maintenance and repair that keeps your production rolling smoothly.

WHEREVER YOU ARE, there is a nearby Allis-Chalmers Certified Service Shop to keep your motors and other electrical equipment running smoothly. These independent shops are selected after careful investigation for their up-to-date equipment, experienced personnel, good business practices and will to serve. They use only factory-approved parts and methods.

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No one knows more about correct motor and starter application than your A-C Certified Service Shop. When you need new motors or starters, check with the one in your area or with your nearest A-C Sales Office.

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Serviced . . .

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CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

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For over half a century, "HERCULES" (Red-Strand) Wire Rope has been proving its outstanding quality by the accurate yardstick of performance—on all sorts of jobs, and in one industry after another. Such *consistent* performance is not a matter of chance. Design . . . rigid tests and inspections . . . equipment . . . firm standards — are essential factors.

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BUCYRUS ERIE Spudders on drilling, well completion, and workover jobs!

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Look over the entire line of Bucyrus-Erie spudders — 24-L, 28-L, 36-L, and 48-L. Check the profit possibilities they hold for you. See your nearest Bucyrus-Erie distributor today for further information.

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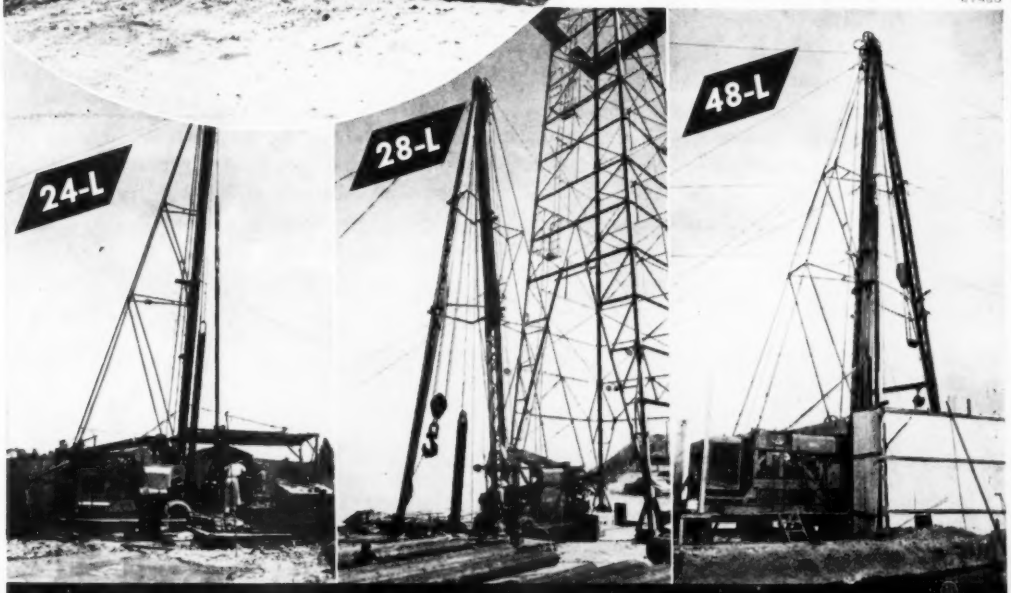

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Distributors in All Principal Oil Fields
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A complete stock of the supplies and equipment needed by the drilling and producing oil industry, friendly, helpful service by trained and experienced personnel . . . these are the stock-in-trade of United. Whether you need a complete rig or one valve, you'll find your United men ready and able to give you interested and intelligent service. United men are good folks to know.

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Stores in Kansas, Oklahoma, Texas, Louisiana, and New Mexico

FIREPOWER! —for speedy control of oil and gasoline fires!

● This completely self-contained, high-speed, high-volume, 240 hp. Walter Fire Fighter is ready for instant action no matter where an outbreak occurs. It speeds unfailingly through sand, mud, soft dirt, snow, ice, slippery surfaces, because it has the 100% traction of Walter Four-Point Positive Drive. Accelerates to 45 mph. in one minute. Carries 1,000 gal. of water, 90 gal. of foam liquid for mixing, 800 lbs. of carbon dioxide. Equipped with two turret jets, three ground-sweeping jets and three handline jets, discharging a total of 4,800 gal. of fog-foam per minute which blankets, smothers and seals the fire in a matter of seconds. Write for full information.

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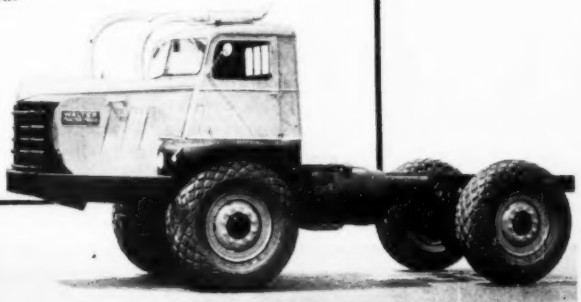
● Only Walter Tractor Trucks bring you the great haulpower and 100% traction of Four-Point Positive Drive to keep loads moving fast on soft dirt, mud, sand, snow, grades and other difficult running conditions. Walter Tractor Trucks are especially adapted to trailer hauling of rigs, pipe and servicing equipment. Powerful engines from 240 to 300 hp., high ground clearance, rugged construction, easy maneuvering and handling. Haul bigger loads, reduce traveling time, eliminate costly tie-ups by using Walter Tractor Trucks on your tough cross-country hauls. Get full details.



WALTER
4-POINT POSITIVE DRIVE
TRACTOR TRUCKS

Write for full information on these Walter units.

WALTER MOTOR TRUCK CO., 1001-19 Irving Ave., Ridgewood 27, Queens, L. I., N. Y.

This is Why the Nash is the Most Simple Compressor

It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods. Data on these pumps sent immediately on request.

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY
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RECTORHEADS UNDAMAGED BY FIRE THAT DESTROYS RIG

Haney No. 2, Snyder, Texas back on production in 2 hours

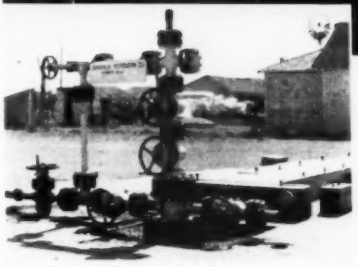
Intense heat melts pressure gauges...turns head to cherry red...but fails to damage welded and steel seals in Rector casing and tubing heads.

When the cellar full of oil on the Haney No. 2 well at Snyder, Texas caught fire, the Rector Casing and Tubing heads were in the heart of the fire which burned for hours, and damaged the rig beyond use. The welded seals plus an API ring in these heads were neither weakened nor burned out.

When the fire was extinguished, the tubing was plugged, new master valve and Xmas Tree installed and the well put back on production within two hours. Operator was saved the delay and cost of killing the well, moving in new rig to repair damage that would have occurred in heads with resilient seals.

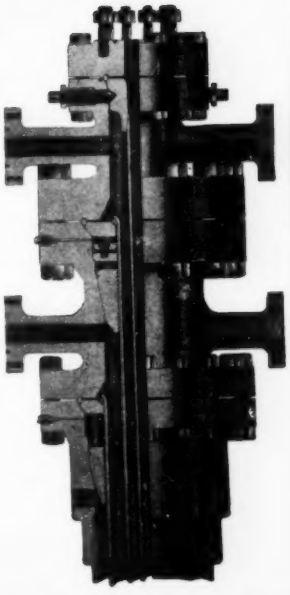
Thanks to the steel seals in the Rectorheads, no leaks developed, which would have caused a disastrous blowout, with possible loss of the well!

It pays to protect your well against every eventuality by using Rector Casing and Tubing heads. Their welded seals plus an API ring can't burn out; can't leak due to fire; are immune to the effects of corrosion inhibitors; require no replacement. Call your nearest Rector Representative or write for catalog.



RECTORHEAD ASSEMBLY AS USED ON HANEY NO. 2

The hook-up of Rectorhead illustrated at right is the same as that on the Haney No. 2 well. It consists of a 13⅜" OD 8 round thread x 8⅝" OD type 6RH, 4000= Test RECTORHEAD on bottom. The intermediate head is a nom. 12"-600 by 10"-900 Type 9RH 6000= Test, RECTORHEAD, suspending 5½" casing. The tubing head is a nominal 10" by nominal 6" type 9M 6000= Test RECTORHEAD suspending 2" EUE tubing. NOTICE THERE IS NO RESILIENT PACKING OR SOFT SEAL IN EITHER CASING HEADS OR TUBING HEADS.



RECTOR WELL EQUIPMENT CO., INC.

Fort Worth, Texas

Fort Worth Plant
1100 N. Commerce St.

Houston Plant
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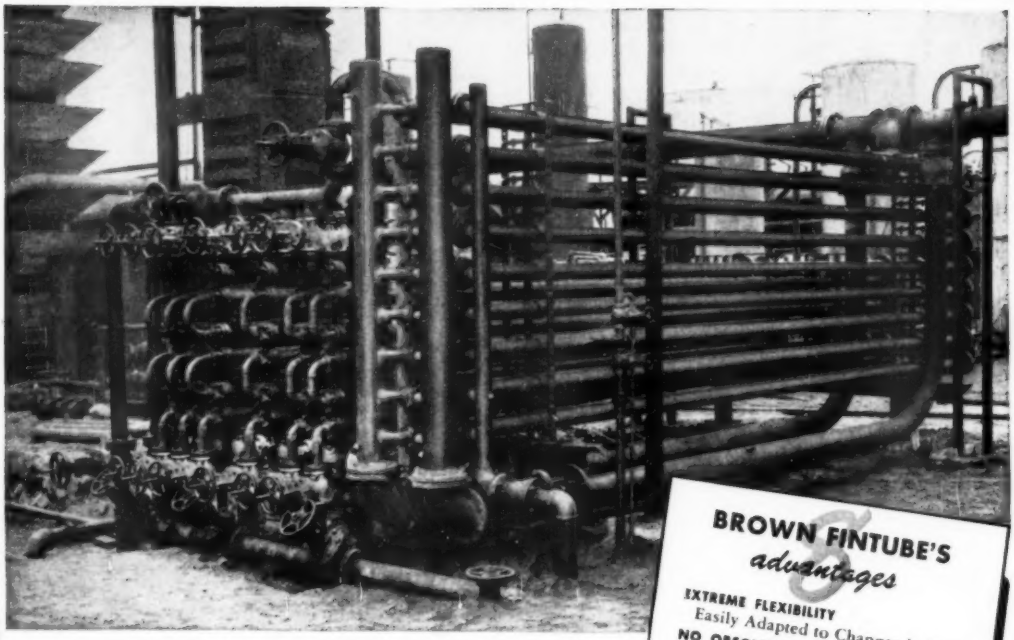
REPRESENTATIVES IN ALL ACTIVE FIELDS

RECTOR

RECTORHEAD

MAKING THE OIL INDUSTRY SAFER!

ASSOCIATION OF WELL HEAD MANUFACTURERS CERTIFIED



BROWN FINTUBE'S *advantages*

EXTREME FLEXIBILITY
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NO OBSOLESCENCE
Avoiding Waste and Expense
FLANGED HEAD END ASSEMBLY
Eliminating Ground Joint Seals
EASY MAINTENANCE
Using Only Common Tools
CONTINUOUS OPERATION
No Shut-Downs For Cleaning
REDUCED STORES REQUIREMENT
Minimizing Investment and Handling
QUICK DELIVERY
Only a Few Hours in Emergency
INCREASED CORROSION ALLOWANCE
Longer Tube Life

continuous operation

Brown Fintube Sectional Exchangers Eliminate Shut-downs for Cleaning Pay Users Extra Dividends

● By simply manifolding an extra parallel stream into the bank, one stream after another can be taken off-line and cleaned, while the exchanger operates at full capacity.

This avoids the necessity of carrying a 100% standby unit to insure continuous operation. It permits the sections to be cleaned as frequently as the duty requires, without effecting other parts of the plant, and assures *clean surfaces* and *efficient* operation, year after year, without shut-down.

For the utmost in efficiency and economy — use Brown's proven, welded fintube heat exchangers throughout your plant. Estimates and quotations furnished promptly. *Write for Bulletin No. 481.*

THE BROWN FINTUBE CO.
ELYRIA, OHIO

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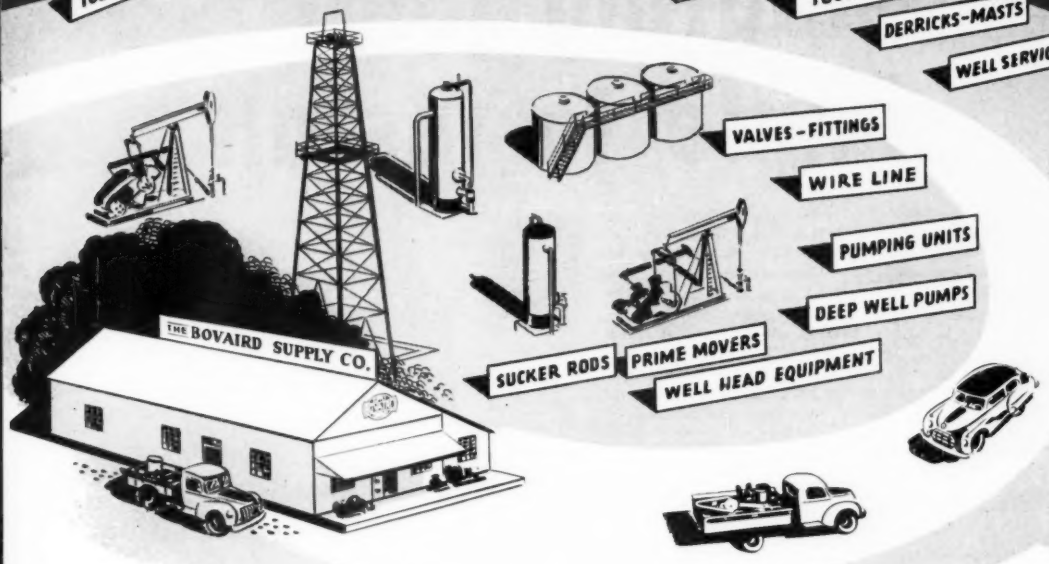
Take the Bovaird Road...

TUBULAR PRODUCTS
DRILLING RIGS
ROTARY TOOLS
DRILLING MUD
ROCK BITS
TOOL JOINTS
DERRICKS-MASTS
WELL SERVICE UNITS



VALVES-FITTINGS
WIRE LINE
PUMPING UNITS
DEEP WELL PUMPS
SUCKER RODS
PRIME MOVERS
WELL HEAD EQUIPMENT

to Dependable Service

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BOVAIRD has been constantly checking field conditions and equipment since 1871 to find the best supplies to meet the needs of the oil industry. The brands stocked by BOVAIRD represent the best. Each product handled by BOVAIRD is field tested and proved to give you long-lasting, trouble-free service under the most severe field conditions.

For a Better Buy—

"Buy From Bovaird"

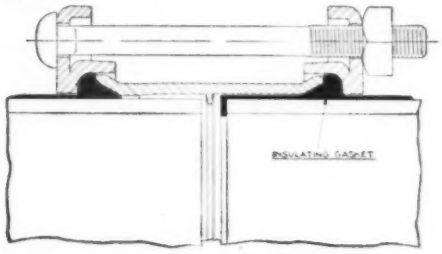
THE Bovaird SUPPLY CO.
GENERAL OFFICES
TULSA, OKLAHOMA

Low-cost, flexible insulating joint is simple to install

Where it is desirable to sectionalize a main for the application of electrolytic protection—or wherever insulating joints are indicated—Dresser Insulating Couplings, Style 39, provide ultimate protection at lower cost. There is no exact pipe fitting required and the joint itself costs but a fraction of the cost of more cumbersome insulating methods.

An additional advantage is that Style 39's with pipe stop bead removed can be cut into existing mains with a minimum of trouble and expense. Gaskets are of special rubber compound, as shown in cross-section drawing, or with protective plastic skirt where line contents might affect rubber compounds.

Sizes $\frac{1}{2}$" through 30" and up. Also reducing sizes for going from steel to CIP.



Dresser ZIPCOATS* complete insulating joint protection... Easy and safe to install

Installed in 1/10 the time it takes to coat a joint, ZIPCOATS give sure protection, superlative dielectric strength. Simply zip them up like a jacket. There's no flame; no heating, hauling or messy application of hot stuff; no danger from fumes or burns. Three types: for insulating joints and for the straight run of pipe, including welds. *Write for literature.*

*ZIPCOAT is a Trademark of Dresser Manufacturing Division

Fast bonding. Preformed Dresser Bonds and 5-second chemical welding method make homogeneous weld area, eliminate surface contact variables. Save up to 50% of cost of bonding. Compact kit of preformed bonds includes all materials needed for installing.

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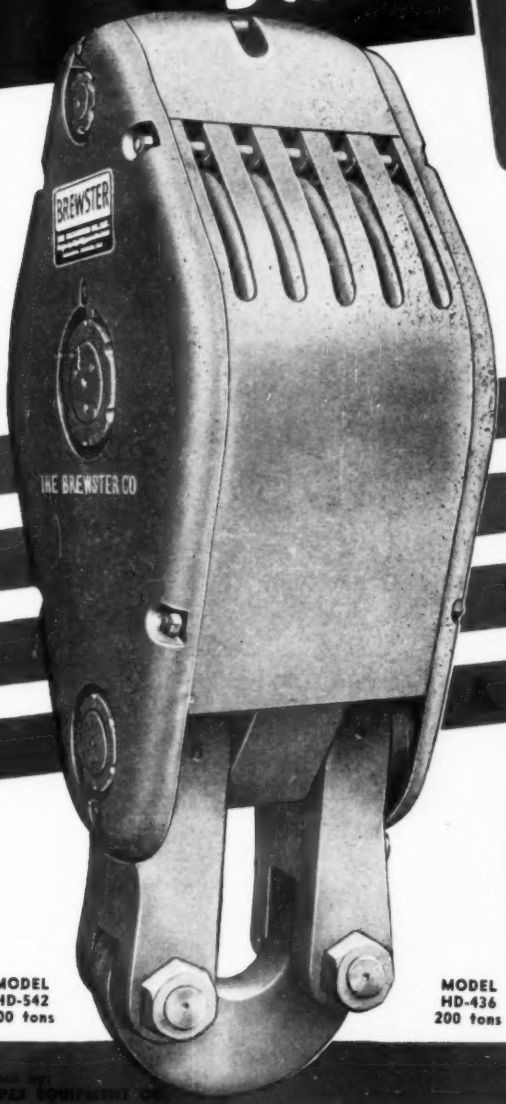
Driller's Choice

FAST

SAFE

BREWSTER

HEAVY DUTY TRAVELING BLOCKS



Brewster sheaves are cast electric alloy steel. Machined grooves are flame hardened for greater wear, longer life. Each sheave is mounted on double-row tapered roller bearings for greater stability. Sheaves are individually lubricated through center pin.

PERFECT BALANCE

STRAIGHT FALL

SAFE SMOOTH DESIGN

SIZE FOR ANY DEPTH

Capacities from 90 to 300 tons.

MODEL HD-436 200 tons

For fast, safe, dependable performance, Brewster Heavy Duty Traveling Blocks are preferred everywhere. Their straight line travel without weave or wobble means longer life for drilling lines. Streamlined shape—no dangerous projections. Write today for full information.

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The BREWSTER CO., Inc.

Manufacturers of Drilling Equipment Since 1910

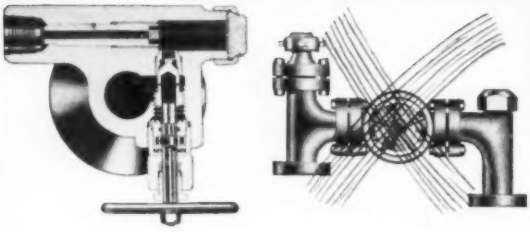
SHREVEPORT, LOUISIANA, U.S.A.

BREWSTER *Drilling Equipment*

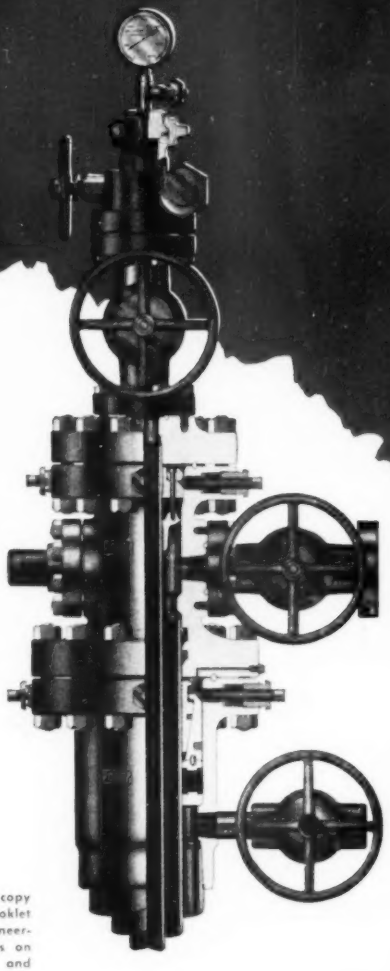
O-C-T "JE"

FLOW CONTROL UNITS

Save more than 90% over conventional tubing wings!



In a single, compact unit, the O-C-T "JE" Flow Control Unit replaces a tee or cross, wing valve, choke and bottom hole pressure adapter.



This compact, easy operating O-C-T "JE" Flow Control Unit . . . adaptable to either positive or adjustable chokes . . . performs the functions and takes the place of a Christmas Tree cross or tee, wing valve, adjustable or positive choke and the upper bottom hole pressure connection adapter. It eliminates the flange connections between the tee and the bottom hole test adapter, between the tee and the wing valve and between the wing valve and the choke. Thus, O-C-T "JE" Flow Control Units effect a cost saving ranging as high as 90 per cent when used to replace 10,000 lb. test conventional wings. In addition, O-C-T "JE" Flow Control Units effect weight savings up to 70% . . . operate free and easy at high pressures . . . provide quick, easy field maintenance.

O-C-T "JE" Flow Control Units are now proved in service by more than 2000 installations. They are available through all recognized supply stores.

Write today for your free copy of a 16-page illustrated booklet which gives complete engineering specifications and prices on the "JE" Flow Control Unit and conventional wings.

The operator of this 6000 lbs. test O-C-T Christmas Tree made a substantial saving when he specified the "JE" Flow Control Unit.

Oil Center Tool Co.

P. O. Box 3091, Houston, Texas

Export Representatives: Venezuela, Colombia, Peru, and Ecuador—Berry & Hall, Apartado No. 304, Maracaibo, Venezuela—Sterling Areas—Le Grand, Sutcliff & Gell, Ltd., Southall, Middlesex, England. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston 1, Texas.

Spicer Universal Joints—

BUILT LIKE AN OX

Not an ounce of excess weight

Built for work . . . steady, safe, dependable. Big and broad in the shoulders, fortified by sinews of steel that handle heavy loads with ease and efficiency. Rigidity —*the essence of accuracy*— is assured by Spicer one-piece solid yoke construction. Spicer "built-like-an-ox" construction has patented features that will serve your equipment better . . . on the boulevard or in the backwoods. Spicer Universal Joints are built with a reputation to maintain . . . a 46-year service record unequalled in the industry. With this prestige we have an obligation to fulfill . . . in engineering, manufacturing and service of the highest order.

SPICER MANUFACTURING • *Division of Dana Corporation*
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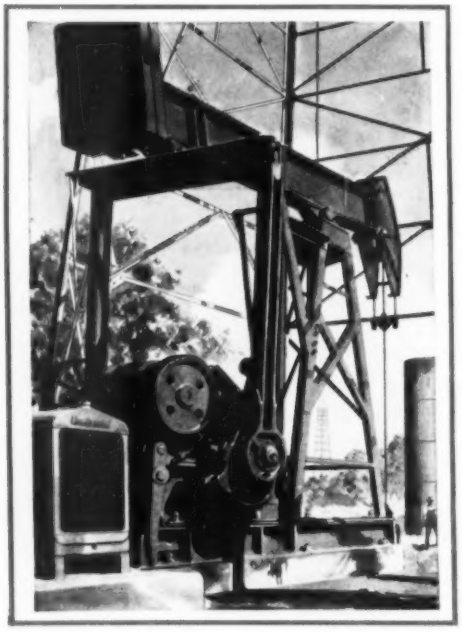
46 YEARS OF Spicer SERVICE

TOLEDO 1, OHIO
PARISH FRAMES
STAMPINGS
CLUTCHES

THERE'S
ONE BEST ENGINE
FOR EVERY OIL FIELD JOB
. . . AND
CONTINENTAL BUILDS IT!

CONTINENTAL MOTORS — Powerful as the Nation — AMERICA'S STANDARD

Where power plant dependability is as vital as it is in the oil field, it's extra important that the engine fit its application . . . extra wise to specify Continental Red Seal power. By doing so, you get the benefit not only of exclusive features making for economy and long life, but also of Continental's long experience, PLUS a degree of specialization that is unsurpassed. Between the Continental limits—¾ to 270 horsepower—there's a model engineered for practically every oil field job . . . an engine built to do that one job and do it superlatively well.



CONTINENTAL ALONE OFFERS ALL THESE FEATURES

Exclusive Continental system of individual porting, for easy starting and smooth operation.

•

Directional cooling for maximum thermal efficiency under all running conditions.

•

Dynamically-balanced alloy steel crankshaft with Tocco-hardened journals.

•

Patented oil and dust seals to exclude moisture and dirt, minimizing wear.

•

Leakproof water pump with widely-spaced bearings, grease-packed and permanently sealed.

•

Easily-removable tappets for quick adjustment or servicing.

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Continental Motors Corporation

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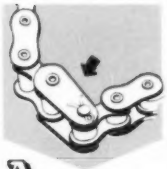
WHERE YOU SEE THIS... YOU SEE

Longer Chain Life, Lower Chain Cost, Easy Adjustment, Faster Service!

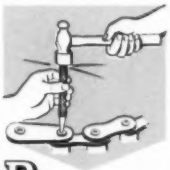
This distinctive "teardrop" shape link marks the new "BA"... Baldwin Assembly . . . oil field roller chain. And it's the mark of long low-cost drilling service.

The new "BA" assembly roller chain gives you all the advantages of riveted roller chain . . . long life . . . greater strength . . . lower cost . . . plus even greater ease of field assembly and disassembly than with old style detachable roller chains.

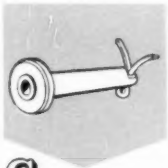
HERE'S HOW SIMPLE IT IS!



A The single pin connector is the heart of the "BA" assembly and is readily identified by its "teardrop" shape. One pin in this link has a cotter on one end; the other end is spun over a washer. The other pin is fully riveted to the adjacent link, thus assuring the assembly of the superior life of riveted chain.



B To take the chain apart, simply remove the cotter on the single pin connector link and drive out the pin. Pin is a slip fit through the chain except for a milled flat on the cottered end which is fitted into a special hole in the connector plate. There is no danger of destroying fits or damaging parts with this chain.



C The single pin connector of the "BA" assembly fits snugly into place . . . even though it is a slip fit through virtually the entire link. The washer spun over one end of the pin and the milled flat on the cottered end that is fitted into the special hole in the connector plate, plus the cotter, hold the pin firmly in place.

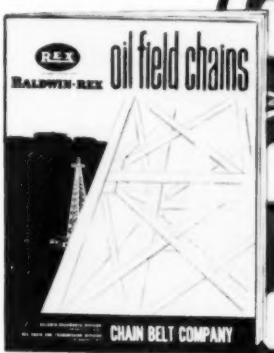
D An important advantage to you is the fact that the other end of the single pin connector link is firmly riveted to the adjacent link. When the single pin connector is removed, this riveted pin holds the chain parts together, preventing plates from falling out and greatly simplifying assembly.

For all the facts on the "BA" assembly, Rex A.P.I. Chains and Rex Oil Field Pumps, see your local supply store or write Chain Belt Company, 1619 W. Bruce Street, Milwaukee 4, Wis.

BALDWIN·REX

ROLLER CHAINS

a complete line from ¼-inch to 2½-inch pitch



CHAIN BELT REX COMPANY

A.P.I. CHAINS

Stay on the Job...Longest!

These famous rotary drilling chains . . . *the chains that have grown up with the oil fields* . . . are built especially for oil field needs. Their ability to take the stresses and strains of tough drilling is the result of such outstanding features as:

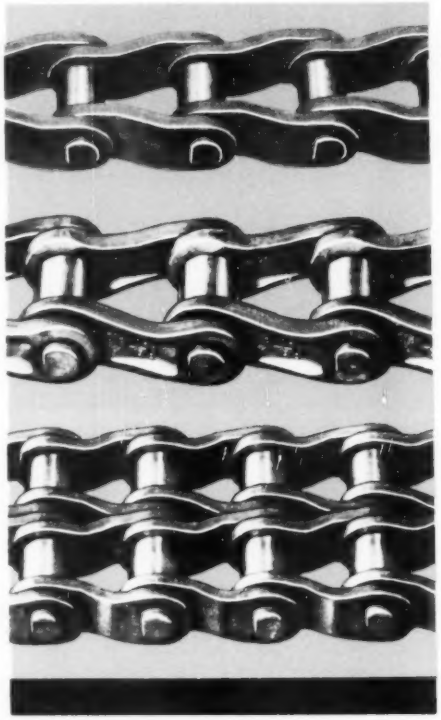
BALANCED DESIGN, an important Rex advantage that balances the strength of the chain parts for increased efficiency . . . longer life . . . lighter weight.

MAXIMUM WEAR RESISTANCE, effected by carefully hardened and finished pins, bushings and rollers. All are made from solid stock alloy steel. Pins and rollers are of heat treated, high carbon alloy steel. Bushings are of alloy steel, case hardened for wear resistance.

FORCE FIT ASSEMBLY. Chain parts are carefully machine-assembled to form the famous Rex Unit-Link. Each link is exactly alike . . . each is put together to stay . . . to retain its strength and uniformity under the toughest of drilling conditions.

EFFECTIVE LUBRICATION that prolongs chain life. Oil holes in the bushings put oil where it is needed.

EASY TO TAKE APART. Rex 3-diameter pin makes assembly and dis-assembly easy. No need for heavy driving or the use of drift pins.



Rex Champion Chabelco A. P. I. No. 3. Ultimate strength 75,000 pounds.

Rex Champion Chabelco A. P. I. No. 4. Ultimate strength 170,000 pounds.

Rex D3125 A. P. I. No. 3⅛. Ultimate strength 230,000 pounds.

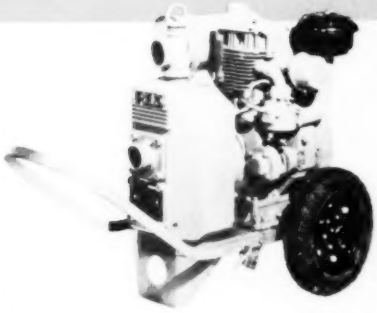
CHAIN BELT REX COMPANY

OIL FIELD PUMPS

THE IDEAL PUMP OF OIL FIELD UTILITY SERVICE

The handy Rex "little yellow pump" is used wherever water is pumped. Its lightweight, durable pressed steel body assures easy portability from job to job. Exclusive "adjustable air peeler" and replaceable wearing plate assure new pump efficiency for lifetime of the pump. The peeler permits the pump to handle vapors without losing its prime.

For dependable utility service, rely on Rex, the "little yellow pump." You just start the motor and forget the pump. It keeps right on going while there's water to pump.



Rex Oil Field Sales Offices Are Located in the Following Cities:
NEW YORK • TULSA • DALLAS • HOUSTON • MIDLAND • LOS ANGELES

CHAIN BELT COMPANY

BALDWIN-DUCKWORTH DIVISION
Springfield 2, Mass.

REX CHAIN & TRANSMISSION DIVISION
Milwaukee 4, Wis.

REX CONSTRUCTION MACHINERY DIVISION
Milwaukee 4, Wis.

CUT COSTS 50%

on corrosion-resistant pipe

Yes, pay as little as *half* what you've been paying—get corrosion-resistant Alcoa Aluminum Pipe. Pay less for installation, too—Alcoa Pipe weighs just one-third as much as ordinary pipe. It's easier to handle, easier to install or move.

Alcoa Aluminum 63S Pipe is highly resistant to corrosion by sulfur compounds; safely carries many chemicals, petroleum products, foods, commodities. The product won't hurt the pipe and the pipe won't hurt the product. In fact, Alcoa Pipe is often used where maintenance of color and purity are of utmost importance.

Alcoa Aluminum Pipe is seamless and comes in ⅛" to 12" standard pipe sizes. Easy to join by familiar methods and with standard fittings and flanges available from nationally-known manufacturers. For your nearest supplier, call your local Alcoa Sales Office (branches in 55 cities) or write ALUMINUM COMPANY OF AMERICA, 1978D Gulf Bldg., Pittsburgh 19, Pa.

FREE BOOKLET

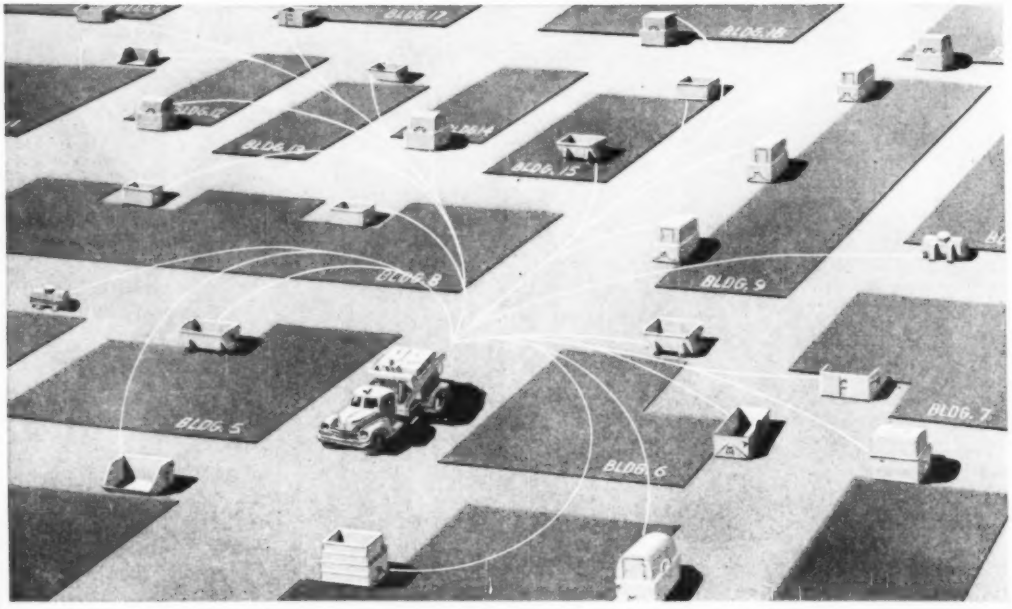
Gives you the whole story on Alcoa Aluminum Pipe—physical and mechanical properties, applications. Write today for your copy.

FOR LOCAL SOURCE OF ALCOA ALUMINUM PIPE AND OTHER ALCOA PRODUCTS, LOOK UNDER "ALUMINUM" IN YOUR CLASSIFIED TELEPHONE DIRECTORY

ALCOA ALUMINUM PIPE

ALCOA ALUMINUM

INGOT • SHEET & PLATE • SHAPES, ROLLED & EXTRUDED • WIRE • ROD • BAR • TUBING • PIPE • SAND, DIE & PERMANENT MOLD CASTINGS • FORGINGS • IMPACT EXTRUSIONS
ELECTRICAL CONDUCTORS • SCREW MACHINE PRODUCTS • FABRICATED PRODUCTS • FASTENERS • FOIL • ALUMINUM PIGMENTS • MAGNESIUM PRODUCTS



★ Never Before Have You Been Able To Cut Bulk Materials Handling Costs So Drastically

Pictured above is a skeleton layout of a typical industrial plant using the Dempster-Dumpster System — one truck mounted Dempster-Dumpster handles the entire group of 26 Dempster-Dumpster containers of six different types. These big, detachable steel containers are like having 26 truck bodies for a single truck.

Any required number of Dempster-Dumpster containers are spotted at convenient materials accumulation points inside and outside your plant. They range in sizes up to 10 cu. yds. and are made in various designs to suit your particular needs. Materials — bulky, light, heavy, solids, rubbish and even liquids—are dumped or placed in these containers. The truck mounted Dempster-Dumpster makes scheduled rounds, picks up each preloaded container, carries it to the point of disposal, sets it down intact or dumps the materials and returns the container for refilling. The entire operation is hydraulically controlled and handled by only one man, the driver.

It is not unusual for one Dempster-Dumpster to eliminate up to 10 conventional trucks . . . reducing investment accordingly. This means cutting maintenance costs, tire and gas requirements tremendously. And, more important, it increases production with a minimum of manpower. It will pay you to investigate the Dempster-Dumpster System now! A product of Dempster Brothers, Inc.

Above, the Dempster-Dumpster is shown in the three simple stages of picking-up, hauling and dumping an 8 cu. yd. drop bottom container . . . completing the cycle in one to two minutes. These photos show the ease with which the Dempster-Dumpster handles all containers, regardless of their type, size or whether they are bottom or tilt dumping types.

The important feature to remember is that only one truck-mounted Dempster-Dumpster and driver handles one container after another in an endless cycle, constantly on the move for economy and efficiency never before available in bulk materials handling.

DEMPSTER BROTHERS, 540 Dempster Building, Knoxville 17, Tennessee

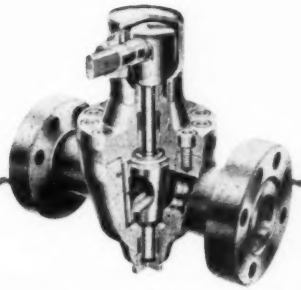
THIS SEPARATE AND REPLACEABLE SEAT

PROVIDES

3 BIG ADVANTAGES

IN THE NEW

Cameron NON-LUBRICATED LIFT-PLUG VALVE



THE BEST FEATURES OF PLUG AND GATE VALVES COMBINED WITH NEW CAMERON INNOVATIONS

- NON-LUBRICATED—no grease of any kind required to effect a seal; also reduces chance for human error and need for maintenance.
- PRESSURE SEALING—when plug is seated, line pressure automatically forces seat into tighter engagement with plug.
- UNIQUE LIFT-PLUG ACTUATOR—a novel mechanical design which lifts, turns and reseats plug in continuous turn of a lever.
- RENEWABLE SEAT AND PLUG—easily replaced; permits any desired trim.
- FIELD REPAIR—can be completely overhauled without removal from line; no special tools or skill required.
- EASY OPERATION—requires less operating effort than other valve designs.
- FORGED STEEL—all parts, including body, are press or drop forged from specification materials.

A TIGHT SEAL

When the Cameron "LP" Valve is in closed position the plug is firmly wedged into the seat to secure a primary metal-to-metal seal. Then, line pressure exerts forces on an exterior portion of the separate seat to press it into even closer sealing contact with the plug. The seat and body being separate members, body distortion cannot separate the seating surfaces.

EASY FIELD REPAIR

Here, again, the separate and replaceable seat of the Cameron "LP" Valve provides an important advantage over conventional valves having seats made integrally with the body. No skill or special tools are required to completely overhaul the "LP" Valve, and it is not necessary to remove the valve from the line. (See above.)

ANY DESIRED TRIM

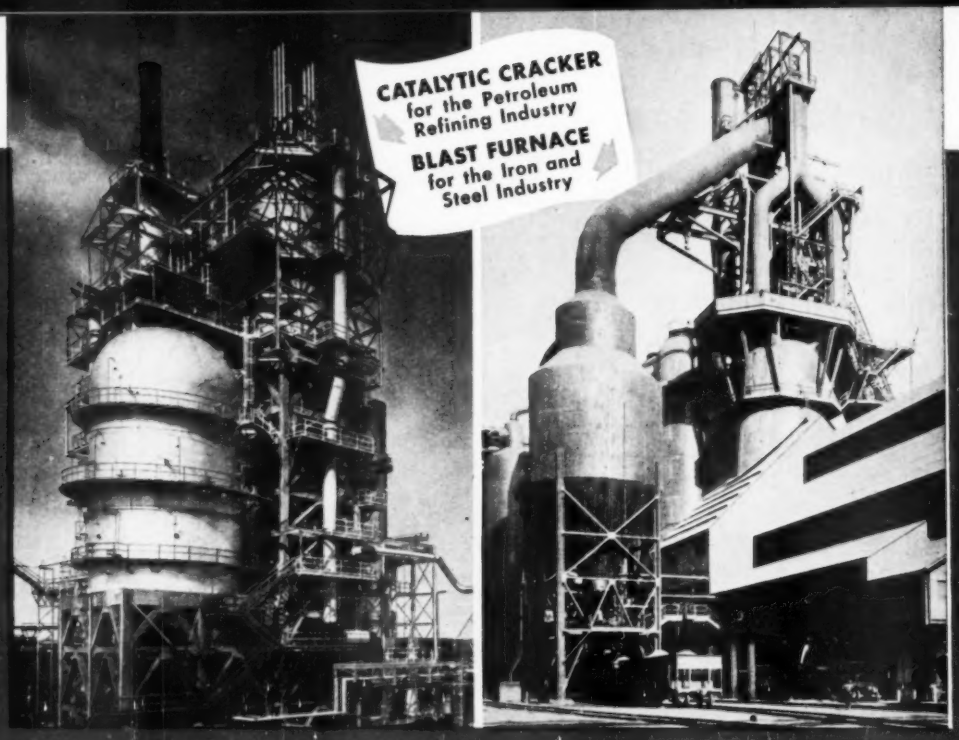
Obviously, the seat of the "LP" Valve which is separate and not attached to the body permits the selection of trim materials best suited for the service conditions.

Completely descriptive literature and dimensional data will gladly be sent to interested operators upon request.

Cameron IRON WORKS, INC.

P. O. BOX 1212 HOUSTON, TEXAS

EXPORT: 74 TRINITY PLACE, NEW YORK, N. Y.



McKEE BUILDS *Processing Machines*

FOR BOTH OF THESE INDUSTRIES

WHAT OIL MEN AND STEEL MEN WILL TELL YOU ABOUT McKEE ENGINEERING:

They'll tell you McKee engineering is ***thorough***—that McKee builds sound, practical production facilities for ***both*** industries.

McKee's knowledge and experience in oil and steel prove advantageous to McKee clients in each industry and has solved problems in other fields.

McKee service is prompt and construction rapid. That means lower costs and earlier completion of a profit producing plant.

Wherever iron and steel are produced or oil is refined, successfully operating McKee-built plants prove "***McKee Engineering means assured results***".

● It may be any type of refinery from a crude distillation unit to a catalytic cracker . . . a blast furnace, open hearth or ore beneficiation plant, but in each case ***the plant is the machine.***

McKee builds these multi-million-dollar "plant-machines" for two of the world's basic industries—Petroleum Refining and Iron and Steel.

Where successful operation and profitable investment depend so much on the plant itself, plant design must be ***correct***—engineering ***thorough***—and construction ***sound.*** That's why oil men and steel men all over the world call on McKee for all types of production facilities.

ARTHUR G. McKEE & COMPANY

DESIGN, ENGINEERING AND CONSTRUCTION FOR THE PETROLEUM REFINING AND IRON AND STEEL INDUSTRIES

ENGINEERS AND CONTRACTORS • ESTABLISHED 1905
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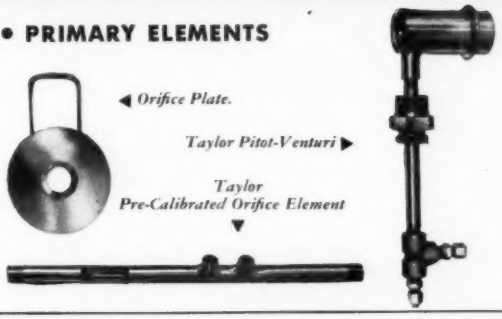
30 Rockefeller Plaza, New York, N. Y.

LET TAYLOR HANDLE YOUR FLOW PROBLEMS

• PRIMARY ELEMENTS



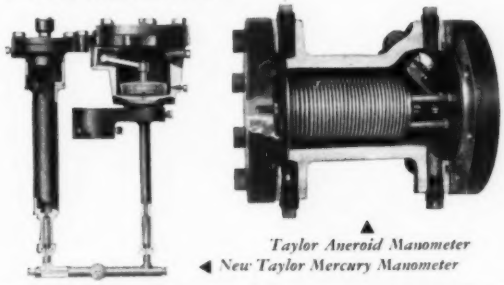
◀ *Orifice Plate.*

Taylor Pitot-Venturi ▶

Taylor Pre-Calibrated Orifice Element ▼

(1) Thin and thick type Orifice Plates from 2 to 24" in all standard materials. (2) Pre-Calibrated Orifice Assembly for high-accuracy with pipe sizes less than 2" are a "Specialty of the House" with Taylor. (3) The new and exclusive Taylor Pitot-Venturi Flow Element which produces greater differential with practically no pressure loss—7 to 10 times greater than by the conventional Pitot Tube. (4) Also standard Venturi Tubes. (5) Flow Nozzles from 3 to 14" in all standard materials.

• FOR MEASUREMENT

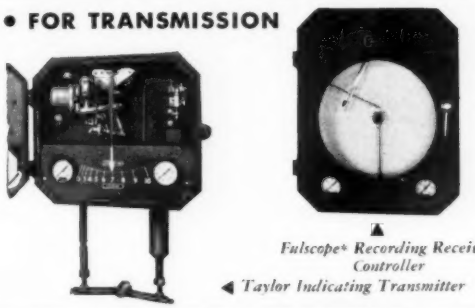


▲ *Taylor Aneroid Manometer*

◀ *New Taylor Mercury Manometer*

(1) New Taylor high-accuracy Mercury Manometer which features Teflon bearings, high energy output, submerged check valves, ½ of 1% accuracy, an adjustable leakless damping unit, and interchangeable range tubes for continuous ranges from 10 to 533 inches of water. (2) Taylor Aneroid (Mercury-less) Manometer, available in All-316 Stainless Steel or Cast Steel, accurately measures flow of hard-to-handle corrosive materials. No mercury to replace, no stuffing box. Sealing fluids or blow-back systems seldom needed. Long service. Easy cleaning. Easy range changes. Both Manometers available with Square Root Integrators.

• FOR TRANSMISSION



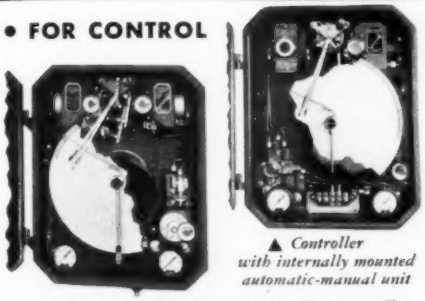
▲ *Fulscope* Recording Receiver Controller*

◀ *Taylor Indicating Transmitter*

Taylor Remote Transmission Systems accurately, quickly, economically, and safely transmit rate of flow to conveniently located point. Transmitters can be indicators, recorders or controllers. High accuracy—systems are calibrated to within ½ of 1% accuracy. High speed—only 2-second lag in 300 feet. Gives central control of widely distributed processes at one convenient point. Concentric dial transmitter with Mercury Manometer also available.

*Trade-Mark

• FOR CONTROL



▲ *Controller with internally mounted automatic-manual unit*

▲ *Fulscope Recording Pneumatic-Set Flow Controller*

Indicating or recording controllers in single or double duty form, with adjustable sensitivity or automatic reset. Ratio Flow Controllers with two Manometers attached. Control point may be adjusted by any other process variable. Pneumatic-set controllers whereby control point can be pneumatically adjusted from any remote location. Internally or externally mounted automatic to manual units.

• • •

For complete details, write for new Flow Catalog 98175, or ask your Taylor Field Engineer. He'll show you how Taylor Instrumentation can help you solve *any* flow problem. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

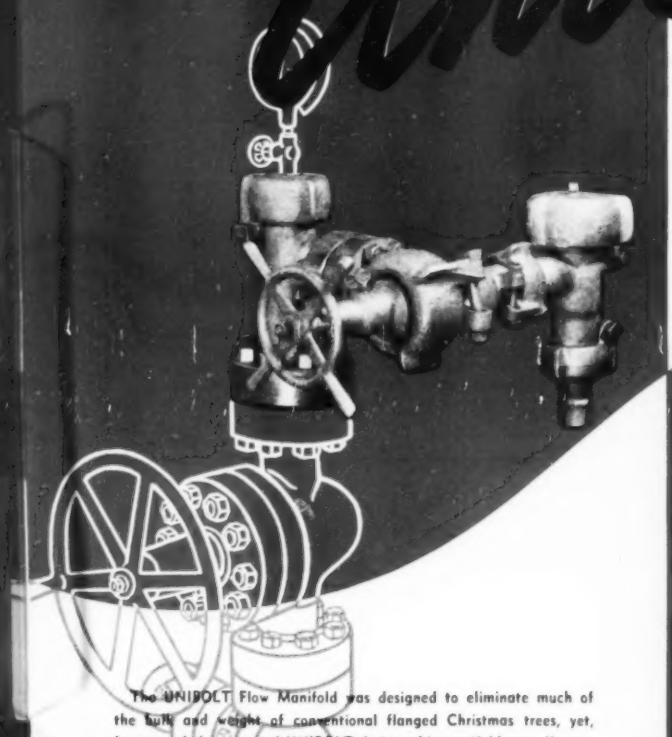
TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

TELL YOUR CHRISTMAS TREE SUPPLIER TO FURNISH

Unibolt

FLOW MANIFOLDS

—THEY MAKE ANY TREE LIGHTER, STRONGER, MORE ECONOMICAL!



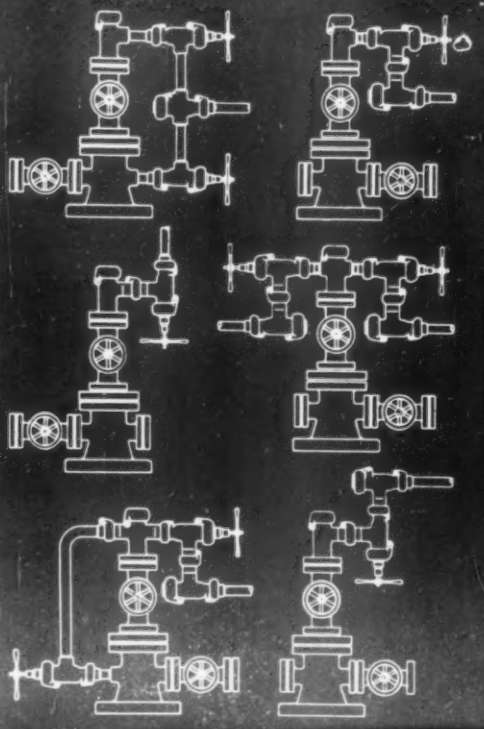
The UNIBOLT Flow Manifold was designed to eliminate much of the bulk and weight of conventional flanged Christmas trees, yet, because of the patented UNIBOLT design, this manifold actually provides a higher factor of safety than the heavier flanged manifolds.

The use of a UNIBOLT Adjustable Wing Valve instead of an ordinary gate or plug valve on the wing is an innovation that has met with the approval of numerous operators, due to the fact that it provides a dependable and easy to operate wing valve, requires no grease to effect a seal, costs substantially less, and can be completely overhauled without removal from the well.

Another important advantage of the UNIBOLT Flow Manifold is its complete interchangeability. All connections in the manifold are standard forged steel UNIBOLT Couplings, and any unit in the assembly, or part thereof, may be easily and quickly replaced in the field without removing the manifold from the well.

See your Composite Catalog for complete details, or write direct for literature.

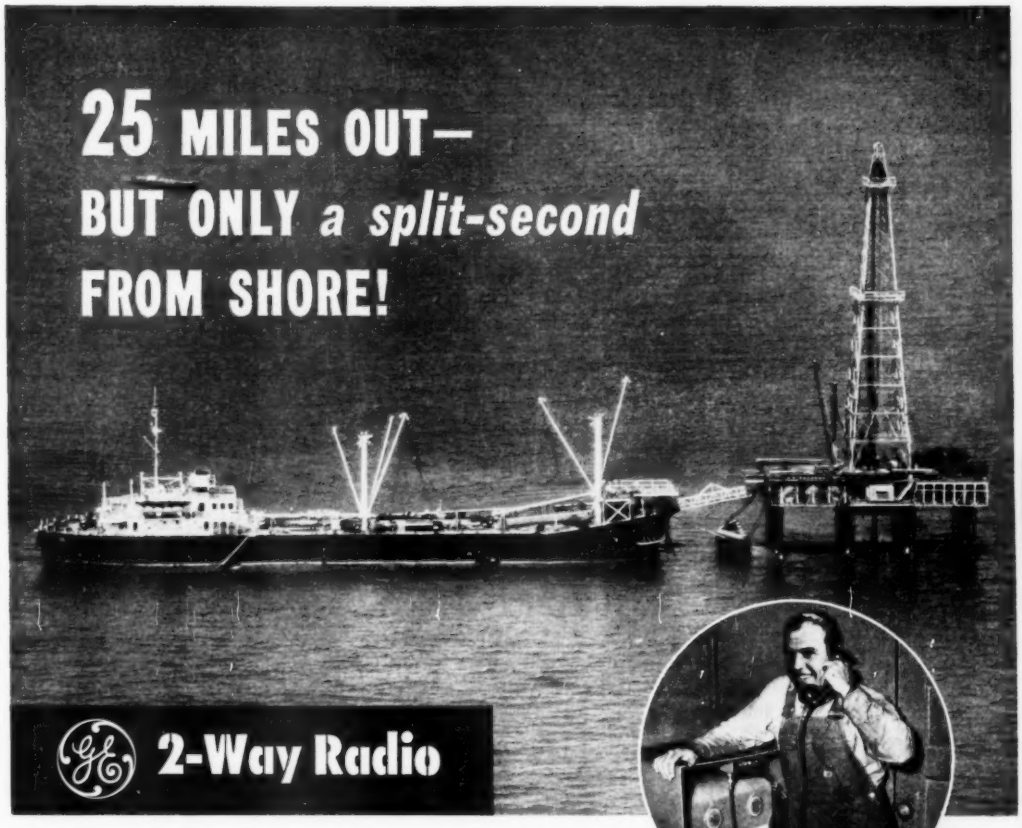
UNIBOLT ADJUSTABLE WING VALVES AND POSITIVE CHOKES MAY BE ASSEMBLED IN ANY DESIRED TYPE OF MANIFOLD TO BEST SERVE INDIVIDUAL WELL REQUIREMENTS



THORNHILL-CRAVER CO.

HOUSTON UNIBOLT TEXAS

25 MILES OUT— BUT ONLY *a split-second* FROM SHORE!



2-Way Radio

THE California Company drilling platform and supply ship shown here are far out in the Gulf of Mexico, but rig crews can talk to shore offices instantly—at any time, in any weather. General Electric 2-way radio units on platforms, supply vessels, workers' transport boats and oil barges, as well as at shore points, give this "ocean" oil operation a tight communication net that promotes efficiency, cuts costs.

California—like many another major producer—employs General Electric mobile radio in exploration, land and water drilling, pipeline construction and operation, transportation and refining—wherever instant communication is necessary or delay expensive.

G-E *narrow-band* equipment is particularly suited to the communication needs of the petroleum industry. Call the General Electric office in the city nearest you for full information. Meanwhile, let us send you the booklet shown below. It's worth your attention.

● Write for Bulletin X55-752 on radio communication equipment for the petroleum industry. *General Electric Company, Section 840-27, Electronics Park, Syracuse, N. Y.*

You can put your confidence in—

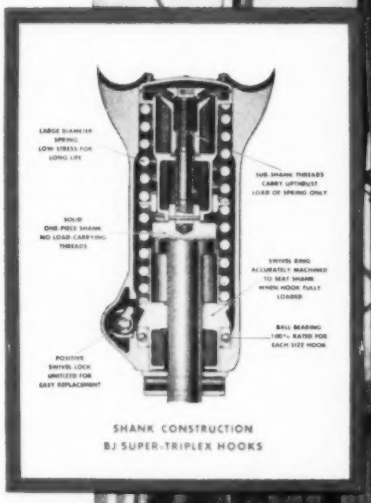
GENERAL ELECTRIC

BJ Super-Triplex and Duplex HOOKS

You DON'T buy a hook every day. So when you do, take a good look at the engineering and construction you get. It's *basic* features like these that put BJ Hooks on 9 out of 10 drilling rigs:

Extra strong weldless construction for today's heavier strings and deeper drilling • solid one-piece forged shank — no load-carrying threads • 100% ball bearing swivel action for easy rotation under all loads • 6 to 8 inch spring travel for "floating" action • rated capacities from 60 to 300 tons • 4 to 1 safety factor • Triplex body for use with a swivel bail • Duplex body for drilling with a swivel bail adapter...the BJ "Stubby" for use where every inch of space in portable masts is required.

Whether it's slim hole drilling or a new deep try, BJ has the *right* hook for your string of tools. Engineered overall construction and design features are essentially the same from the smallest to the largest BJ Hook. *In the hook you buy* get these *basic* features—buy BJ!


LARGE DIAMETER SPRING LOW STRESS FOR LONG LIFE
SUB-SHANK THREADS CARRY UPTHRUST LOAD OF SPRING ONLY
SOLID ONE-PIECE SHANK NO LOAD-CARRYING THREADS
SWIVEL RING ACCURATELY MACHINED TO SEAT SHANK WHEN HOOK FULLY LOADED
BALL BEARING 100% RATED FOR EACH SIZE HOOK
POSITIVE SWIVEL LOCK UNUTILIZED FOR EASY REPLACEMENT
SHANK CONSTRUCTION
BJ SUPER-TRIPLEX HOOKS

LOCKING ARM DESIGN
UPPER LOCKING ARMS OPEN FOR EASY ENTRY OF LINKS
AMPLE CLEARANCE DESIGNED TO ACCOMMODATE HEAVIEST SWIVEL BAIL
HEAVY OVERHANGING SECTION TO TAKE POUNDING FROM SWIVEL BAIL
SADDLE TYPE LOWER LOCKING ARM ELIMINATES WEAR TO BODY SECTION

BJ MEANS ENGINEERED OIL TOOLS

Byron Jackson Co.
Since 1872

Main Office & Plant: Los Angeles 54, Calif.
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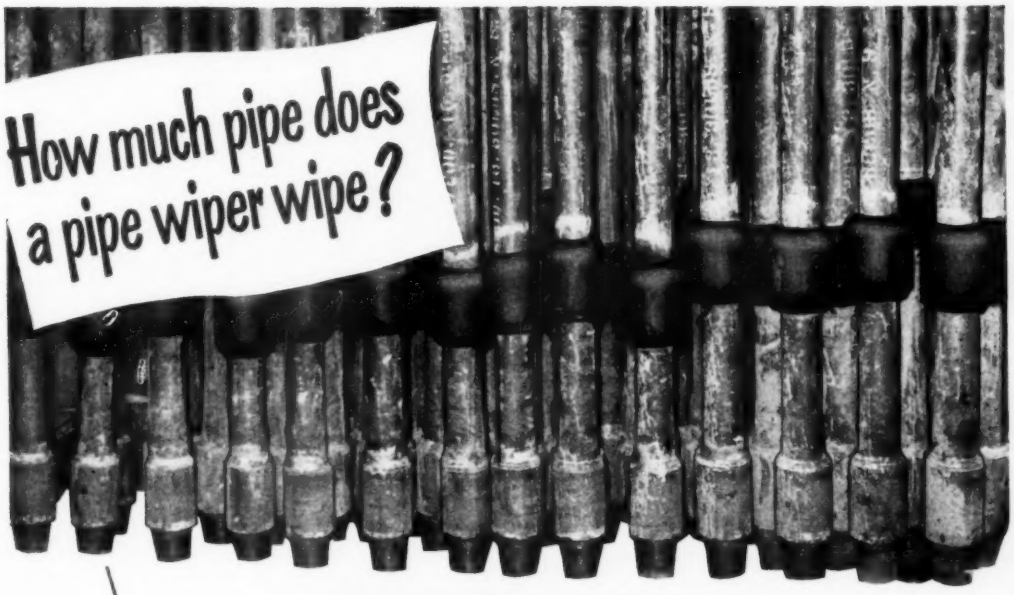
Stocking Jobbers All Principal Oil Fields



PLENTY when it's a

PB PIPE WIPER!

TRIP AFTER TRIP . . . under the toughest of conditions . . . you get *greater pipe cleaning efficiency* due to PB's design and rugged construction. PB's field-developed and field-proven rubber gives you longer life and greater wear resistance because of scientific blending and careful laboratory control. When you order Pipe Wipers—order PB . . . all sizes for all needs!

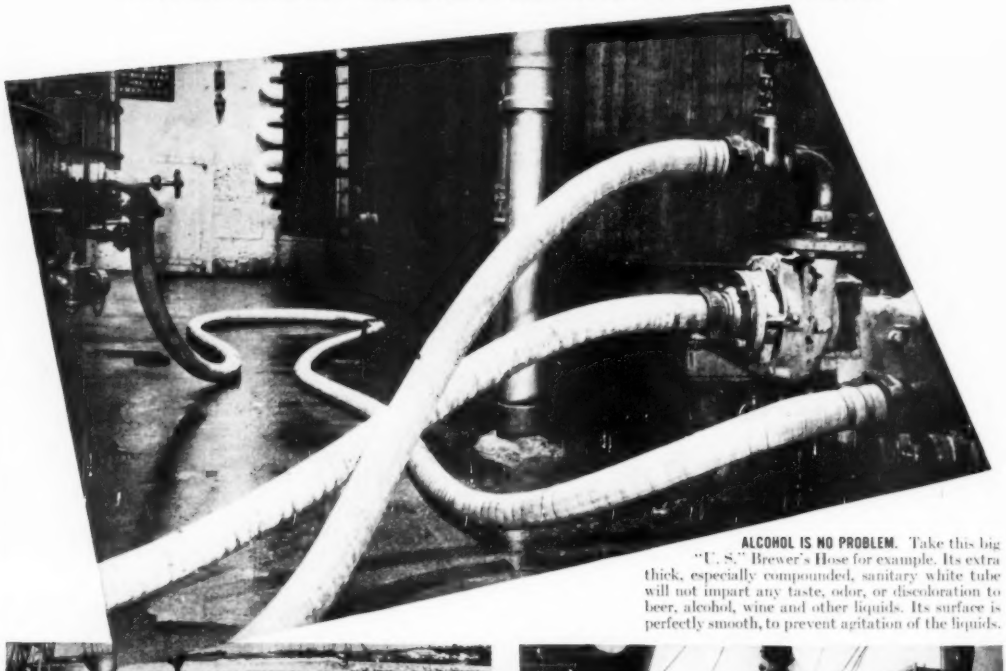
See Your Patterson-Ballagh Representative—or write for the complete PB Catalog today.

Patterson-Ballagh

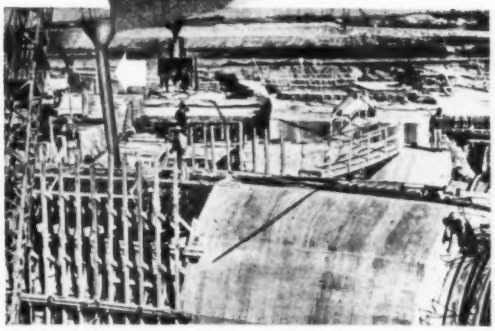
MAIN OFFICE: 1900 SAINT JOHN STREET
LOS ANGELES 1, CALIFORNIA

TODAY'S HOSE CAN SWALLOW ANYTHING!

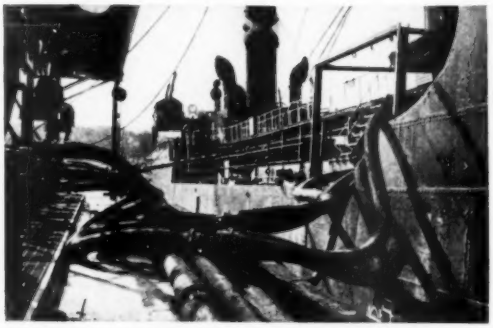
U. S. RUBBER'S LINE OF FLEXIBLE CARRIERS INCLUDES PRODUCTS THAT CAN HANDLE PRACTICALLY ANY DESTRUCTIVE LIQUID KNOWN



ALCOHOL IS NO PROBLEM. Take this big "U. S." Brewer's Hose for example. Its extra thick, especially compounded, sanitary white tube will not impart any taste, odor, or discoloration to beer, alcohol, wine and other liquids. Its surface is perfectly smooth, to prevent agitation of the liquids.



ON THIS BIG DAM in the Middle West contractors used U. S. Elephant Trunk Hose for dropping concrete speedily and efficiently into tight forms and inaccessible places. Since the hose is flexible, it can be maneuvered and led into spots where concrete could not be dropped directly.



RESISTANCE TO PETROLEUM OILS is built into U. S. Oil Hose for suction or discharge work at refineries, terminals, and loading or unloading tankers or barges. The special U. S. constructions combine adequate pressure resistance and durability while allowing required flexibility.

United States Rubber Company makes hose that resists powerful acids, paint and chemicals of many kinds. No matter what your hose problem may be, you can be sure that "U. S." technicians either already have the right answer, or will obtain it for you. Write:

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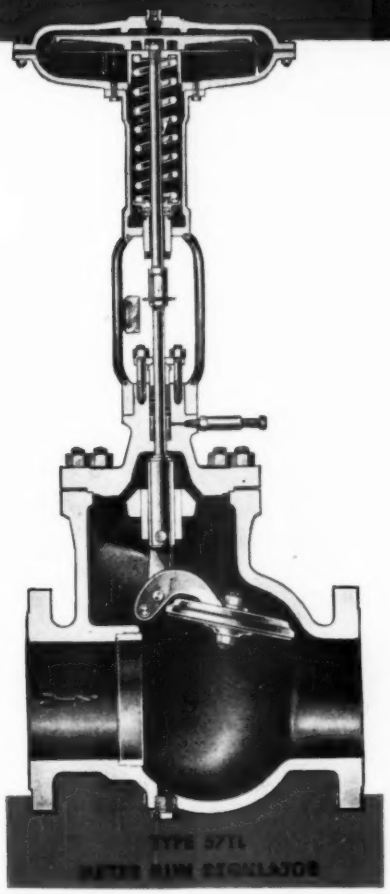
U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.



Minimum Resistance

With no more resistance to flow than a cloud to a jet fighter, the Fisher Type 57TL is a new meter run shut-off valve. Provides greater rangeability of meter settings. Pneumatic top work, 2 to 15 PSI, operated from differential limit controllers. Designed for minimum resistance, the flapper lifts clear of the flow stream.

Available in iron or steel bodies, sizes 4″ through 10″; composition disc for tight shut off.

WRITE TODAY FOR FURTHER DETAILS

FISHER
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POWERED BY WILLYS' SENSATIONAL NEW HIGHER-COMPRESSION F-HEAD ENGINE

4-WHEEL-DRIVE WILLYS TRUCK
5300 LBS. GVW
—118-IN. WHEELBASE

HALF-TON WILLYS TRUCK
4250 LBS. GVW
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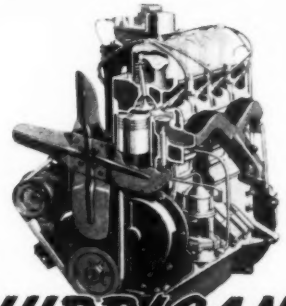
Willys Dealers invite you to see the standout line of the light duty field—new models—new styling—and America's most advanced power plant, the F-head *HURRICANE*. Power has been increased 20 per cent, *yet operating economy is greater than ever*. Compare them with any in their class—

THE NEW ½-TON WILLYS TRUCK, on 118-inch wheelbase, for rock-bottom hauling cost.

THE NEW 4-WHEEL-DRIVE WILLYS TRUCK, 118-inch wheelbase—the truck that goes through mud, sand and roadless country when no ordinary truck can.

Inspect them top to bottom—comfortable, wide-vision cabs—low-maintenance functional bodies—sturdy frames—rugged construction that has made Willys vehicles world-famous for long service.

See them at Willys Dealers



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Engine Steps Up Power and Mileage

Sensational in power output for its size and for low fuel consumption! The *HURRICANE* is an F-head design—valve-in-head intake and valve-in-block exhaust—with oversize intake valve. Compression is 7.4 to 1, but premium fuel is not required. An amazing performer—see it!

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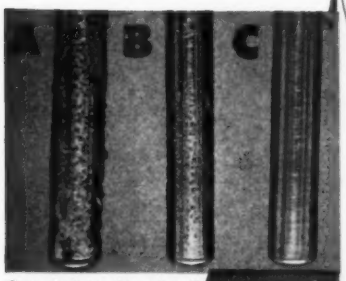
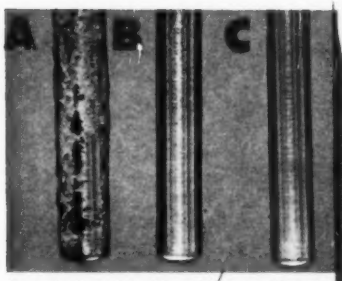


Concentrations of Santolene C [illegible] are as follows: (A) No San[illegible] C, test failed. (B) 10 ppm. Santolene C effe[illegible], but test failed. (C) 20 ppm. Rust absent. Test passed.

test Monsanto SANTOLENE C

SEE HOW IT CAN STOP RUST IN YOUR LINES AND TANKS



Concentrations of Santolene C in tests with fuel oil are as follows: (A) No Santolene C, test failed. (B) 10 ppm. Santolene C effective but test failed. (C) 20 ppm. Rust absent. Test passed.

Send for a sample of Monsanto's newly developed Santolene C. See how it stops rust when added to petroleum products. Figure how much Santolene C can save you in preventing damage to pipe lines or tanks! See if you don't agree that Santolene C is one of the most important petroleum additive developments in years.

Santolene C is effective when used in small amounts. That makes it economical. The cost of inhibiting rust in a 42-gallon barrel of gasoline or fuel oil is usually less than two-tenths of a cent ($0.002).

[illegible]d for your sample of Santolene C today. It will be rushed to you without cost . . . without obligating you or your company. For quick response, mail the coupon. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1745-C South Second Street, St. Louis 4, Missouri.

Santolene: Reg. U. S. Pat. Off.

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MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
1745-C South Second Street, St. Louis 4, Missouri.

Please send, without cost or obligation, sample and data on Monsanto's Santolene C.

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Company .....

Street .....

City ..... *Zone* ..... *State* .....

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DOES YOUR POWER STACK UP WITH LCP* FOR *Flexibility?*

MORE and MORE WELLS ARE PUMPED BY *LCP EVERY DAY!

I'm a **FLEXIBLE** fellow! I can take on a full 24-hour shift or work according to any fractional time schedule! You pay only for the power required to get the job done! My **FLEXIBILITY** —plus automatic control, lower first cost, and lower upkeep stack up in my favor! The Power Engineer of your Utility Electric Power Company has proof of my performance—give him a call today!

*LOW COST POWER

USE *Utility* ELECTRIC POWER

PETROLEUM ELECTRIC POWER ASSOCIATION

GRAVER
CONSERVATION AT WORK
for GREAT LAKES PIPE LINE COMPANY
Sioux Falls, S. D., Terminal. Three Graver Expansion Roof Tanks manifolded to 27 Graver cone roof tanks.

A story of a job well done...

●Several years ago, Graver built petroleum products tankage systems manifolded with Expansion Roof Tanks for the Great Lakes terminals at Sioux City and Des Moines, Iowa; Watertown and Sioux Falls, S. Dak., and Alexandria, Minn.

So satisfactory was the service of the Graver Expansion Roof Tanks that Great Lakes Pipe Line Co. included Expansion Roof Tanks in the specifications for its $55,000,000 expansion program.

The new Graver installations include five 80,000-barrel Expansion Roof Tanks at Minneapolis, four 55,000-barrel Expansion Roof Tanks at Omaha.

Graver installations at Des Moines (one 40,000-barrel Expansion Roof Tank and four 40,000-barrel cone roof tanks) and at Mankato, Minn. (one 40,000-barrel Expansion Roof Tank and three 40,000-barrel cone roof tanks) will be additions to present manifolded systems. Each of these Expansion Roof Tanks will have a 10-foot lift.

This repeat business speaks for itself—a tribute to Great Lakes' progress and testimony to Graver engineering. Ask for case histories on performance and vapor savings with Graver Expansion Roof Tanks. Write now!

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COMPLETE STOCKS and 24 Hour SERVICE

Constantly watching every development in the oil industry, Mid-Continent Supply Company moves rapidly to establish "Around-the-Clock" service in any area where there is oil.

It's part of Mid-Continent's plan for being at the right places "on the map" to give you expert and time-saving service when it is needed.

Our new and well-stocked Mid-Continent store — topped by the famous oil-spouting blue neon derrick is now serving the industry at Snyder, twenty-four hours a day as part of this "on-the-spot" program.

Make Mid-Continent your supply headquarters. In all Mid-Continent stores you will find the merchandise competitive — the service the best!

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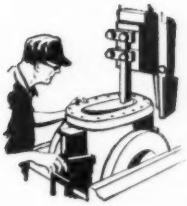
THE WORLD'S LARGEST INDEPENDENT OIL WELL SUPPLY COMPANY



A DISTINCTIVE FEATURE IN DISC GUIDING

Body guides are machined down to precision tolerances, assuring a perfect guide for the disc and creating a positive center line on which all subsequent machining operations are based.

BODY PRECISION MACHINED TO INSURE PERFECT FIT OF SEAT RINGS

This operation makes inserting the seat rings in a Lunkenheimer gate valve simply a matter of screwing them into position. Parts can be replaced without any machine work or special fitting.

Fig. 1430
Iron Body Gate Valve

Fig. 1430 and complete line of I.B.B.M. and All Iron Gate Valves are described in Circular 564. Mailed upon request.

Precision Made LUNKENHEIMER VALVES....

assure perfect-fitting, interchangeable parts . . . longer valve life . . . easier, lower-cost maintenance!

THE smooth working efficiency and low maintenance cost of Lunkenheimer Valves were not "made in a day." Behind this superior performance and economy lies long experience, top engineering and metallurgical facilities together with the most modern manufacturing equipment.

Lunkenheimer Valves have a streamlined simplicity of design . . . a minimum of working parts, each part of extra strength, correctly proportioned and perfectly balanced. This assures longer life with lower maintenance expense.

LET THE LUNKENHEIMER DISTRIBUTOR "TAKE OVER" YOUR INVENTORY PROBLEMS!

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Everything you need to get there EASILY and get down FASTER

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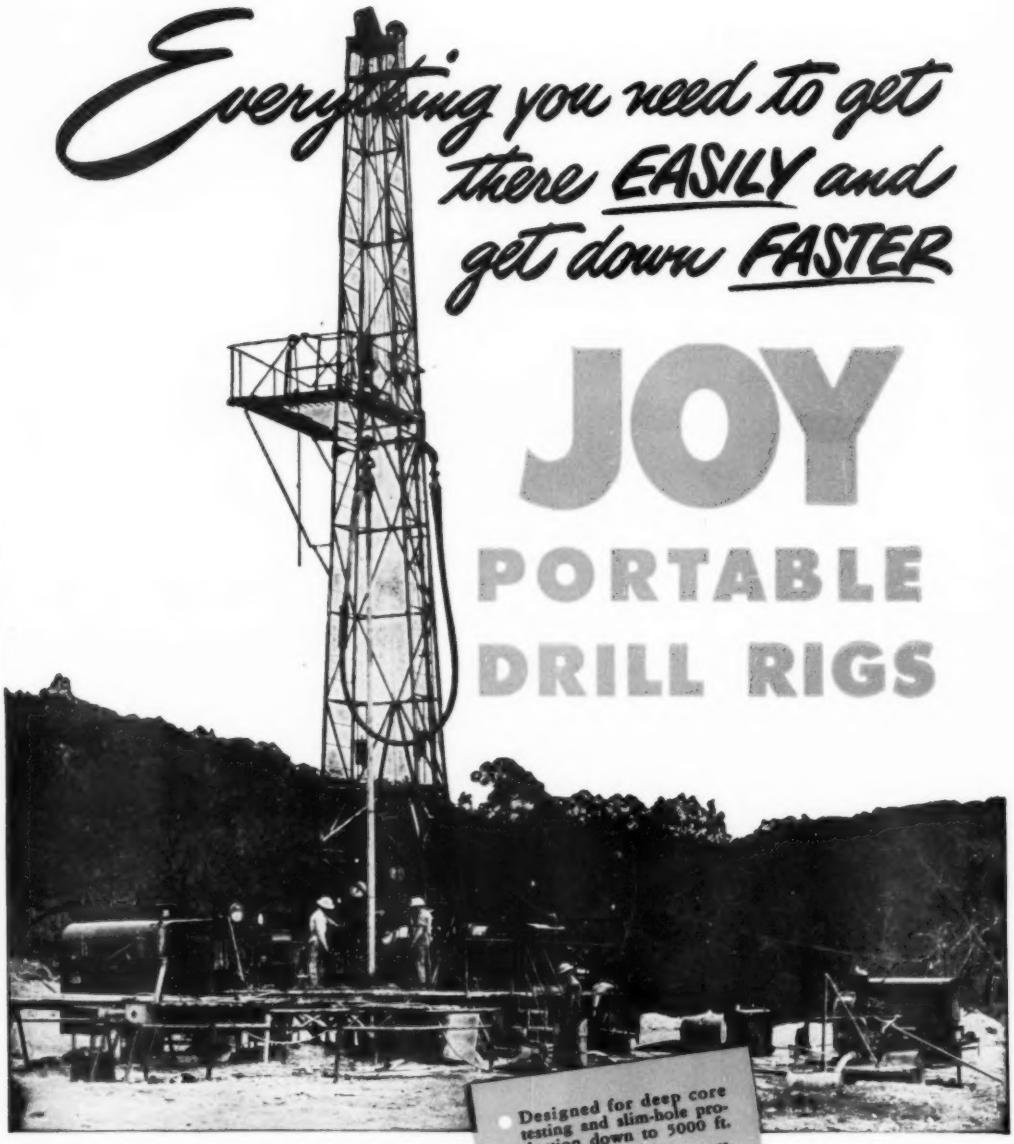
PORTABLE DRILL RIGS



- Designed for deep core testing and slim-hole production down to 5000 ft.
- Compact and highly portable.
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IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

They Say—

Exaggerated Claims

Sir:

I have noted with interest your editorial on "A Propaganda Bureau" appearing in the April 13 edition of The Oil and Gas Journal.

I join with you in deploring the highly exaggerated claims that have been promulgated on the Bureau of Mines' liquid-fuel work. Certainly such claims, as you point out, will do much more harm than good.

I have had occasion to observe closely the secondary-recovery investigations of the bureau, authorized by the O'Mahoney Synthetic Liquid Fuels Act, as chairman of the Interstate Oil Compact Commission's advisory committee on secondary recovery, and can testify to the accomplishments of this program. It has been very creditable work which is providing valuable information to the oil industry.

I have also had an opportunity to read some of the reports prepared by bureau engineers on the results of shale oil and other synthetic-liquid-fuel investigations and can assure you that they have been prepared with proper regard to the facts as they have been developed. It is, therefore, extremely unfortunate that these reports have been so distorted by politicians who are using them for their personal advantage rather than for the good of the oil industry and for the good of the country.

It is to be regretted that the work of able, conscientious, and patriotic men should be used for such purposes, and for that reason it seems to me only fair that the constructive and valuable work of the bureau should be distinguished from obvious political misuse.

Paul D. Torrey,
Lynes, Inc.,
Houston.

Swedish Shale Test

Sir:

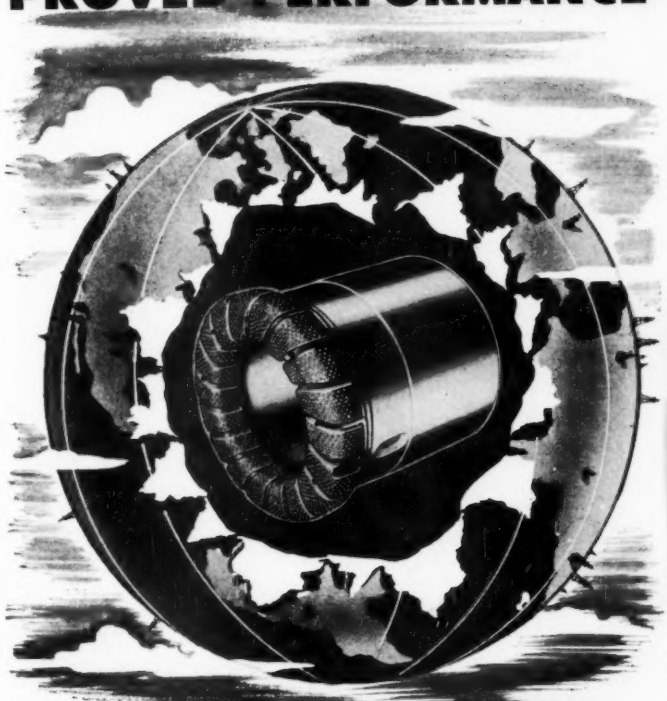
In the March 16 issue . . . appears an article on page 58 relative to a shale test to be made in Sweden.

There are some statements in the article which are in error and I am sure you would like to have them corrected. . . .

Referring to the article, the quantity of shale to be tested is 550 long tons and it will take *one day* to run it through one of the units at the Swedish plant. That plant has a capacity of about 5,000 tons of shale per day.

The Bureau of Mines has no facts at its disposal upon which to base an

PROVED PERFORMANCE



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◆ Less Cost Per Foot

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Fluorescent Magnetic Particle Inspection

Every drilling, oil-tool, or refinery operation can save by inspection to forestall failures in tools and equipment. Inspections with Magnaflux equipment and sensitive Magnaglo indications are most thorough—therefore most dependable, most economical.

With drill collars, for example, fatigue cracks are as likely to develop on the inside female threads as the male end. Magnaglo forms glowing, highly visible indications on all of these cracks, by using fluorescent magnetic particles and correct magnetization.

Oil tool shops now using Magnaflux equipment, report that even in dark inaccessible places, the patterns obtained with Magnaglo make it easy to see where trouble may occur — and prevent it.

An operator, trained by Magnaflux under a continuous service arrangement, quickly pays for the equipment in savings of time, materials and equipment. Companies owning their own Magnaflux or Magnaglo equipment for shop or field inspection save by positive detection of defects before they cause trouble — and by freedom from guesswork which retires sound parts "on suspicion".

Before you spend a cent on inspection equipment, talk to a Magnaflux Field Engineer or write for the facts.

*Magnaflux, Magnaglo, trademarks of the Magnaflux Corporation applied to equipment and material for use with magnetic particle and fluorescent magnetic particle inspection methods.

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Inspect the Inspection Method First — Magnaglo Invites Comparison

opinion such as mentioned in your article with reference to whether or not the Swedish methods would do for the Colorado shale. On the other hand, Swedish Shale Oil Co. has facts at its disposal indicating that its methods are applicable to the successful treatment of Colorado shale. It certainly would not be logical for that company to invite this large semicommercial test if it was not certain of favorable results.

Furthermore, the primary reason for these tests is not to learn whether or not the methods can treat the shale but to obtain the necessary data upon which to base a design for a plant in Colorado. All of the expense in connection with this semicommercial run is borne by the Swedish company after the material has been landed at a Swedish port. I am not familiar with the basis used for the cost figures furnished by the Bureau of Mines, but I can assure you a plant to produce oil with the Swedish methods can be built for much less than the amount mentioned in the article.

Shale is today a great natural resource without present commercial value and, therefore, far more suitable for production of oil than coal.

H. E. Linden, president,
Linden & Co.,
Los Angeles.

Profits Squeeze

". . . Current profits are only 25 per cent above the 1939 level although we are selling three times the quantity of products at four times the gross return. Even that narrow margin of profit could not have been realized without heavy expenditures on the modernization and expansion of our plant facilities.

"Industry's most pressing problem today is to maintain earnings in the face of uncontrollable advances in costs resulting from higher wages, taxation, transportation, and other causes. For British American, the net return per gallon sold has been reduced from 1¾ cents in 1939 to ¾ cent in 1949."

Annual report, British American Oil Co., Ltd.

Tanker Trend

"Tankers . . . now tend to be even larger and faster, with United States ships generally the leaders in size and speed. Although deeper drafts restrict the large tankers to fewer ports, increased costs of shipbuilding and operating justify them. On the basis of cost per deadweight ton, larger ships are less expensive to build than smaller ones, and a 28,000-ton tanker can be operated with nearly the same crew and staff as a 12,000 or 15,000-ton ship. Furthermore, as the waterline length increases, the most efficient cruising

speed also goes up. The so-called super tankers now being built here are generally designed for 16 to 17 knots, and range from 25,000 to 30,000 deadweight tons, with 35,000-ton tankers under consideration. . . A typical modern American super tanker is bigger than the average passenger liner, with an over-all length of about 625 ft., and a beam of over 80 ft. It carries almost a quarter of a million barrels of oil, enough to heat 6,500 average homes for a year."

The Industrial Bulletin of Arthur D. Little, Inc.

Restrictions Abroad

"Our associated companies seek to continue to operate in the sterling area and in other foreign countries on the same competitive basis as the British-controlled oil companies.

"They are willing to compete on a sterling basis, by lowering the dollar-cost component of their products. This the British government recently has been unwilling to allow. In addition to sterling area restrictions on non-British oil, it has entered into bilateral trade agreements with other countries, such as Argentina, Sweden, and Denmark, which result in their oil requirements being supplied by British companies to the growing exclusion of Americans. In doing so, the British disregard the fact that much of their oil has a dollar component also, because a great deal of oil industry skills and equipment, such as pipe, drilling equipment, and refinery elements can be obtained only from the United States.

"The whole policy is directly contrary to our country's advocacy of free and multilateral international trade. The fundamentals of the situation go beyond the oil industry and may eventually affect other American industries."

Annual report, Standard Oil Co. of California.

Contact Wanted

Sir:

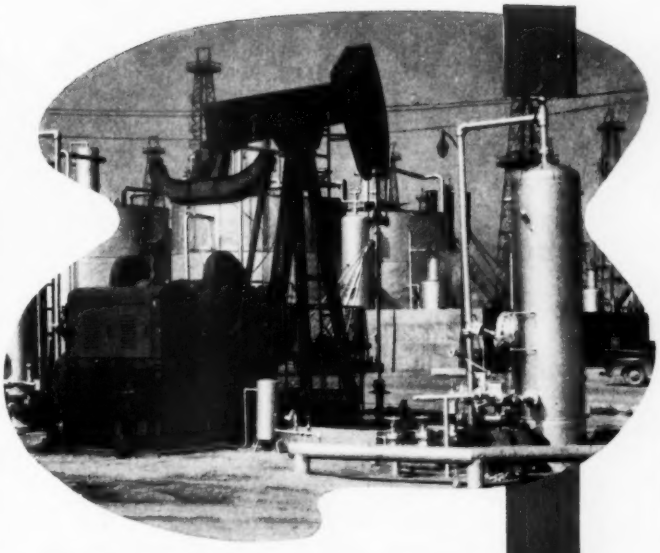
In the December 29 issue of The Oil and Gas Journal I read the following article: "Water Well Drilling Group Elects Officers."

I am a member of the German Water Well Drilling Association, and I would like to come in touch with the Texas Water Well Drilling Association.

I am very interested to know how in the U.S.A. water wells are drilled. . . . (and) about the diameter and the depth. . . .

Werner Muller,
Alfred Wirth & Co.,
Erkelenz, Germany.

New president of the association is O. F. Jensen, Layne-Texas Co., Ltd., 3903 Elm, Dallas.—Editor.



RUST-OLEUM

STOPS RUST!

Add years to the useful life of tanks, pipes, derricks, fences, buildings, roofs and other metal properties by protecting them with RUST-OLEUM. It's a tough, pliable, *long-lasting* coating that seals metal against the ravages of rain, dampness, salty air, weathering and many destructive elements that attack your plant twenty-four hours a day.

Originally developed to combat the most damaging rusting conditions, RUST-OLEUM is widely used by petroleum plants from coast to coast. It has proved its capacity to meet every need of the industry for dependable, long-lasting anti-rust protection.

RUST-OLEUM can be applied without extensive preparation . . . even over surfaces that are already rusted. RUST-OLEUM spreads evenly . . . free of brush marks . . . and dries to a firm, elastic, rust-resistant film.

The time and labor saved in applying RUST-OLEUM mean substantial savings to you in maintenance costs. Yet RUST-OLEUM costs no more than most quality materials.

RUST-OLEUM is decorative, too! It's available in a large selection of colors including white and aluminum.

RUST-OLEUM is stocked and sold by leading industrial distributors in all principal cities in the United States and Canada. If you have a trouble-some rust problem, write for your copy of our catalog which contains full information and recommendations for use.

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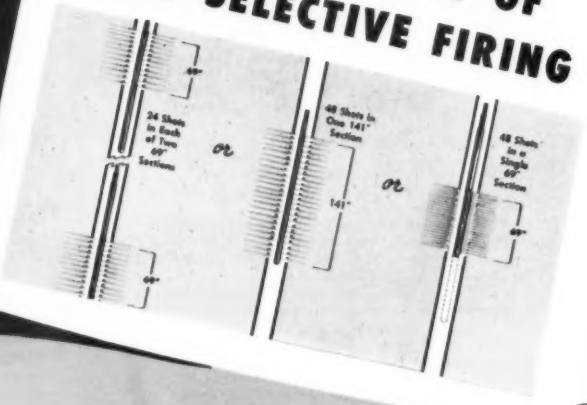

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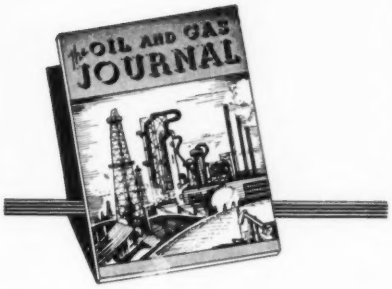

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JOURNALLY Speaking

Something Special

GO west, young oil man, to West Texas, that is, where the reefs and the wildcatters roam, and take with you this issue of our favorite oil publication with its big map and series of special articles on the region.

This issue is really a double special, combining all the West Texas stuff with the full dope on the deliberations of the geologists and such at their triple-barreled Chicago convention. In fact, it is No. 2 in a series of three consecutive specials. Last week was our natural-gasoline special. This week it's geology and West Texas. Next week it will be natural gas.

This sequence of supers was no fun for our editors and printers. It was made necessary by the close bunching of conventions of several associations, each of which deserves—and is getting—a special editorial bill of fare.

Coincidental

FINDING oil with a hose was described in our issue of April 13 (concealed under the title of Seismograph Work With a Single Boat) and the same week B. F. Goodrich Co. busted out with an ad in national magazines bragging about how it made the special transparent plastic hose required for this new technique.

The same picture was used in our story and the ad, a coincidence which tickled our boys no end. Shows that both Goodrich and the Journal don't miss any tricks in keeping up to date on the latest in everything.

This hose deal, incidentally, is really a slick trick. The offshore seismologists string their instruments out in a long hose which trails behind the boat so they can go steaming along at full speed ahead and damn the torpedoes, meanwhile tossing out depth charges like a submarine chaser making a kill.

Point of all this is that the oil finders never stop trying to figure out new gadgets, theories, and methods. This week they are all in Chicago comparing notes on what they figured out last year and are cooking up for the future. And this week, too, the Journal tells all about it, starting on page 89. Only this is not a coincidence. We planned it that way.

Flying Accent

ON page 140 of this issue there is an article on Pegasus field in Texas, and to help you read it with self-assurance we are bringing you this advance lesson in pronunciation.

There are two schools of thought about this name. Some put the accent on the first syllable and say "PEGasus." Others shift it a notch to the right like so: "PeGASus." The disciples of each school are unyielding, and it is said that when a "PEG" man and a "GAS" man are conversing each tries to shout down the other.

The field was named by Magnolia Petroleum Co. in honor of its trade mark, the flying horse of Greek mythology. Our classical education is sadly deficient, but when we studied mythology in third grade our teacher called the winged creature "PEGasus." Of course that was before Socony-Vacuum Oil Co., Inc., corralled him and turned him red (he was white in the picture in our school book) and broke him to harness in the business of selling gasoline for itself and affiliated companies.

We suppose the trade-mark laws permit a company to pronounce its trade mark the way it pleases, but apparently Socony-Vacuum's vice president in charge of pronunciation has not issued a directive to its affiliates because we understand that Magnolia men are about evenly divided on the name of their field. Neither has Webster's International Dictionary been informed of the change, if there is a change, for our edition still puts the accent on the "PEG."

With all this background we hope you will be able to read the article with full knowledge of how to pronounce the name PEGasus (PeGASus) field.

—*Henry D. Ralph.*

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The OIL AND GAS JOURNAL

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Protect THOSE LOW-PRESSURE ZONES FROM CEMENT CONTAMINATION

The difficult problem of cementing a string of casing at a predetermined point above the bottom of the hole, while protecting a permeable, low-pressure zone below from cement contamination is successfully being solved by using Baker Triplex Cementing Equipment.

The features of design and construction which insure its successful performance are "tried and true" Baker principles. Baker Metal Petal Baskets have been used universally for years in many types of cementing; and the Baker "Whirler" principle long has been proved superior to jetting action, which may not only fail to prevent channeling, but may wash out cavities with resultant contamination of the cement slurry.

With the Baker Triplex Cementing Shoe (Product No. 136) all cement slurry is directed upward through side whirler ports of the shoe, and a back-pressure valve prevents any return flow of the slurry. The Baker Metal Petal Basket forms a bridge even in large diameter holes; readily conforms to hole irregularities over a wide range of diameters; and prevents the cement slurry from settling in permeable, low-pressure zones below. A Baker Model "G" Casing Centralizer, positioned just above the Triplex Shoe, assists in perfect cementing performance.

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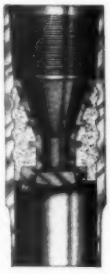
When it is desired to retain cement tailings inside the casing (thus preventing dilution of the cement slurry around and above the Triplex Shoe) either of two collars may be used, *as illustrated below:*

Baker Triplex Cement Baffle Collar (Product No. 137) is used when a stop for the cementing plug is desired, to retain cement tailings inside the casing.



Baker Triplex Flapper Valve Float Collar (Product No. 134 M&F) provides the safety of an additional float valve, as well as a stop for the cementing plug.

Baker Triplex Cementing Shoe, Product No. 136. Named "Triplex" because it performs a "triple" service: (1) is an efficient float shoe for running-in the casing; (2) whirls the cement slurry upward to minimize danger of channeling; (3) Metal Petal Basket expands to form a bridge which prevents cement contamination of low-pressure zones below.

HERE'S HOW *Triplex* BRINGS YOU "BAKERESULTS"

(A) Baker Triplex Cement Baffle Collar, installed a joint or two above the shoe, serves as a stop for the cementing plug. (B) A hold-down strap retains Baker Metal Petal Basket against the "TRIPLEX" Shoe while running-in. (C) Cementing Ports are covered by Tripping Valve until cementing is commenced. (E) After reaching the desired point in the hole, circulation is established through central passageway. A Tripping Ball is pumped down the hole to seat upon the Tripping Valve. Pressure is applied to shear the Tripping Valve shear screws and force the Tripping Valve downward to expose the cementing ports. (F) Shearing these screws also releases the Basket hold-down strap and allows the Metal Petal Basket to expand against the walls of the hole. (D) A resilient rubber, sleeve-type, back-pressure valve opens readily (see dotted white line) to permit passage of slurry into annulus above. Cementing then is carried out in conventional manner with cement slurry directed upward by the exclusive Baker "Whirling" action. Only readily drillable materials are used for all internal parts.—Look in your BAKER (or Composite) CATALOG, or write to BAKER OIL TOOLS, INC., at Houston, Los Angeles, or New York for complete information.

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BAKER *Triplex* CEMENTING EQUIPMENT

An Accomplished Objective

This week at Chicago more than 3,000 exploration scientists are pooling their information on what is required to find today's and tomorrow's oil.

The attendance at the annual meetings of the association and the two societies with a membership of several thousand, is now exceeded only by the annual A.P.I. session. Many, still active in the association's affairs, can recall when they knew most of those in attendance by their first names.

Several developments can be pointed to reflecting the part that geologists, geophysicists, paleontologists, and associated scientists have had in the growth of the petroleum industry.

In the 60-year period between 1859 and 1920 the search for oil in this country resulted in the finding of 12 billion barrels. During the 30 years since then, 53 billion barrels have been found, a tribute to the exploration methods not generally accepted until after the close of World War I.

More and more it is recognized that proven reserves are the foundation of the entire oil and gas industry. Aboveground operating facilities are essential but are useless without adequate inventory of raw materials to develop, process, transport and market. Sales and mergers of integrated operations largely revolve around the accepted figures on reserves.

The responsibility of those assembled at Chicago is constantly to replenish underground reserves. The job is complex. Natural laws control the daily rate at which oil can be released from the reservoirs, while economic laws force the industry to maintain the raw-material inventory at 10 to 15 times the yearly withdrawal in this country.

Until this year postwar meetings have been held under the shadow of threatened shortages. During the emergency, exploration activities were curtailed partially because modern warfare draws heavily on manpower trained in the geological and geophysical sciences. This fact, plus rapidly increasing demands, reduced the usual reserve-production ratio.

There were those, coming largely from outside the industry, and making their own interpretations of supply and demand data, who predicted that never again would the wildcatter catch up with the consumer.

The explorationists were not disturbed. They knew that with new and old tools and with plenty of pipe and other materials for drilling, they could add to the raw-material supply from new sources. By late 1948 and through last year it was apparent that the objective had been accomplished. Results outside this country were even more outstanding.

The prophets of doom with their various schemes, including billions of the taxpayers' money for costly synthetic substitutes, reluctantly have returned to the sidelines. The explorationists, as reflected in the Chicago program, again have time for those basic studies in research and development, which with their intensified and broadened current activities, are the assurance of future supplies.

THIS WEEK

INDUSTRY—NPC meeting this week discusses import controls, natural-gas regulation, synthetic-fuels program. . . . Marketers told to cut costs for stiff competition in buyers' market, cooperate with distributors, stress public relations. . . . Fuel-oil men say aggressive campaign can protect oil-heat market against threat of natural-gas inroads. . . .

GOVERNMENT—Tidelands settlement voted by House committee. . . . Gives oil rights to states out to original offshore limits, federal control beyond. . . . Supreme Court throws out Cotton Valley suit on technicality. . . . First antitrust suit against unit operation of oil fields. . . . Gasoline taxes increased by 16 states this year. . . . Average now 5.11 cents per gallon. . . . Government lending for oil development defended by RFC and Texmass officials. . . .

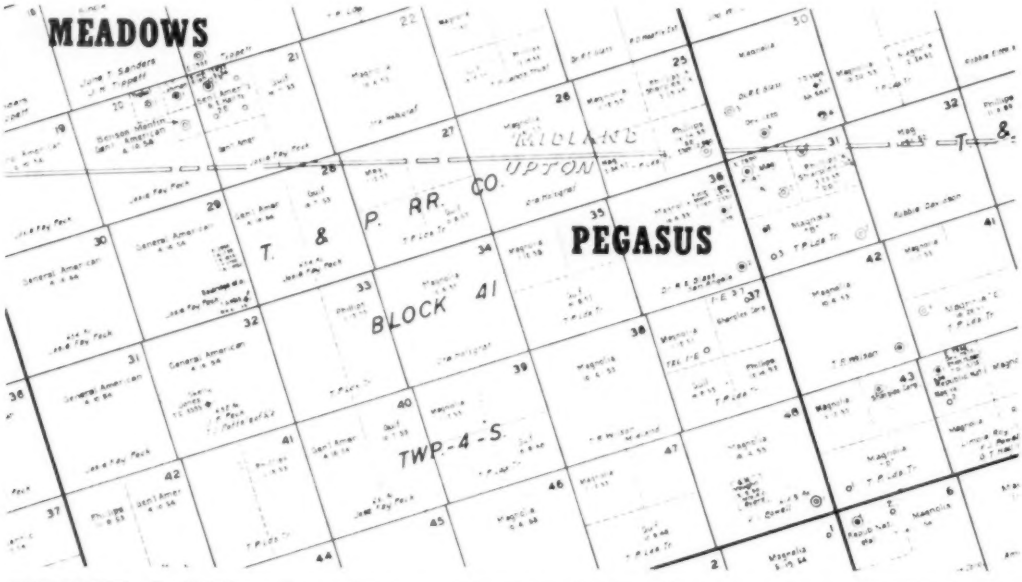
ACTIVITY—Crude production for the week ended April 22 averaged 4,960,125 bbl. daily, an increase of 37,935 bbl. daily over the previous week and 42,225 bbl. daily over same week last year. . . . Well completions for the week increased 7 wells to 749. . . . Wildcat completions gained 24 wells to 157. . . . Rotary rigs operating in United States on April 17 totaled 2,000 rigs, off 37 rigs for the week. . . .

TRENDS—Crude and major-product stocks have been reduced 63,412,000 bbl. or about 600,000 bbl. daily since the first of the year. . . . In the same weeks last year crude and major-product stocks increased at the rate of about 52,000 bbl. daily. . . . Same stocks are expected to show a decrease for the month of April with the crude increase more than offset by the drop in product stocks.

NATURAL GASOLINE—Location of big natural-gasoline plant near delivery end of Tennessee Gas Transmission line stirs interest. . . . Will be tied in with new petrochemical project. . . . Manufacturer warns refiners their failure to use more natural gasoline may disrupt motor-fuel market. . . . N.G.A.A. told gas liquids are 13 per cent of nation's reserves but are not getting proportionate share of market. . . . L.P.G. expert foresees continued growth in demand for these products. . . .

REFINING—Octane race will become more intense. . . . No hope for relief in improved automobile design. . . . Smaller refiners rushing to install new equipment to remain in competition. . . . New military lube specifications criticized by many refiners. . . . Seen as adding another grade to already complicated situation. . . . First commercial synthetic-gasoline plant, Carthage Hydrocol at Brownsville, now undergoing tests, will begin production soon. . . . Sunray will reopen its Allen, Okla., refinery, closed since last fall, because of increased demand. . . .

INTERNATIONAL—World production dropped 1 per cent in February. . . . Venezuela dropped 10 per cent but is turning back up. . . . Persian Gulf output increased 5 per cent. . . . Sinclair's dry hole in Ethiopia presented unusual drilling problems. . . . Wildcatting being curtailed in many foreign areas. . . .



IN WEST TEXAS.—The 22 drilling wells spotted on this map of Pegasus and Meadows fields represent at least $6,000,000 "going down the hole." One of the big discoveries of the past year, Pegasus field has been slow in developing because of the complicated geology and difficult drilling, costing around $300,000 per well. The two reservoirs are proving to be separate structures, sloping sharply toward each other, but each has found production in every zone from the Permian to the Ellenburger. Recent stepouts have found flush production, and the drilling tempo is now speeding up. A report on these fields appears on page 140 of this issue, part of a special section on West Texas.

Climbing Octanes

Direction is up, and auto and fuels makers say it'll stay that way; miracle engine using cheaper fuel still a dream

George Weber

This special report was written by the Journal's refining editor following several weeks of traveling to the nation's principal refining centers and attendance at conventions of the Western Petroleum Refiners Association and the Society of Automotive Engineers. It summarizes the prevailing opinion among refiners and automotive engineers as to the future of the octane race.

NEW YORK.—The octane number of motor fuels is going to continue to inch upward, and the refiner who is not preparing today to meet increased competition in this field is risking his future position in the market.

Nor can the refiner hope for relief in the prospect that the automotive industry will build "mechanical octane numbers" into engines and thus put a limit on the octane race. The hard truth is that newer engines will call for still more high-octane fuel.

These conclusions represent a concensus in refining and automotive circles at the present time.

They are supported by announced plans of automobile builders for engines of higher compression ratio.

They are further substantiated by plans on the part of many refining companies for the construction of new processing facilities to increase the antiknock ratings of their gasolines.

Construction planned.—The prospect for new construction projects at refineries appears greater at this time than it did last December, although the phenomenal construction program of the past 3 years is admittedly past its peak as most of the multimillion-dollar projects are in operation or nearing completion.

A substantial number of smaller construction projects are in the offing. Primarily these are being planned by independent refiners. They involve modernization and various types of process units to upgrade gasoline and keep up with the trend toward premium fuel.

Off-the-record discussions with refiners in many parts of the country reveal that nearly a score of small refineries and natural-gasoline plants are engaged in various stages of modernization plans not yet announced officially. These are located in 10 states, mostly in the Mid-Continent and Southwest.

Most of these operators will install catalytic cracking and reforming units. Among this group interest is strong in new processes and advanced developments in existing processes for improving gasoline octane rating.

No miracle motor.—The belief that the octane race will be halted by introduction of a "miracle engine" which will give high performance on low-octane gasoline is a glimmering hope—unrealistic and dangerous. Discussions with automotive engineers make it clear that such is not in the cards.

Automotive engines will be improved, but not in the direction of giving comparable performance with lower-octane fuel. The trend is unquestionably toward increased car performance and economy using the highest-quality gasoline obtainable.

In other words, any improvements in the design of the Otto cycle engine will be accompanied by increases in compression ratio to take advantage of the power inherent in today's gasoline. It has been stated authoritatively that no motor manufacturer will tool up on any new engine design which will not utilize, with minor adjustments, a compression ratio of at least 10 to 1.

As a consequence, the automotive industry will continue its steady pressure for higher octane. This, plus the brisk octane competition within the oil industry, will keep the octane trend moving progressively higher.

Engine improvements. — The present preoccupation of engine designers is compression ratio, though other improvements are not being neglected. However, it is clear that major improvements involving fuel distribution, mixture enrichment, or combustion-chamber temperatures will be adopted only gradually, if at all.

Most engineers agree that even with the commercial adoption of all possible engine improvements now under study, engines would still be designed to require fuel with as high an octane rating as their predecessors.

The current publicity given experiments with turbines and jet propulsion does not change the picture. General commercial use of gas turbines in automobiles is years ahead, to say the least. Present experimental turbines, while burning kerosine or other low-octane fuels, are extremely uneconomical in fuel consumption and have many other "bugs" to be worked out.

It can be said, then, that no new gasoline-processing units being built or planned for the near future will be rendered obsolete by the sudden introduction of a new automobile engine. Any new developments will be put into use gradually, and would not come into general use during the reasonable amortization period of a high-octane installation constructed today.

Current experiments.—The most likely avenue to improvement of mechanical octane-number effects lies in design of the combustion chamber.

Much research work is being conducted along this line, and experimental studies have proved that increased turbulence obtained by shrouding intake valves and employing squish pistons allows knockless performance on lower-octane fuels. But they also permit higher compression ratios on the same fuels, and it is likely that this will be the trend of these developments.

One such study is the much-discussed TCP engine of The Texas Co. In single-cylinder form, this engine in laboratory tests has shown knockless performance on a wide range of petroleum fuels but it has yet to be tried in multicylinder form or under commercial operating conditions. Should it prove competitive with present prime movers, its impact on gasoline demand would not be felt for a number of years.

Sleeve valves, cooled exhaust valves, improved manifolds, and dual-fuel systems are among other avenues to improvement of fuel utilization which are frequently discussed. While each has a scientific foundation, engineers say that the problems of practical application and commercial use have largely been overlooked.

It seems to be typical that when any one major factor in the operation of an automobile engine is changed the result is a series of complications which require other changes. And when all necessary changes have been worked out, the improvement in efficiency may not be worth the additional cost or the mechanism may be too complicated to appeal to the average car buyer.

Automobile makers view changes of this sort with extreme caution. They feel that the buying public will tolerate no compromise with performance and convenience in order to get a small increase in economy of operation. Reduction in the octane rating of gasoline is not a prime objective with automotive designers.

Scurry Analysis

Operators see nothing to worry about in 300-psi. pressure drop; estimate still stands at "billions of barrels" of oil

Kenneth B. Barnes and Roy F. Carlson

AUSTIN.—Maybe you've heard a report, or rumor, that the bottom-hole pressure in the new Scurry reef pools has dropped 300 psi.

It's true. Recent pressure surveys, taken as a result of the Texas Railroad Commission's shutdown order of the field for that purpose show that North Snyder has had a drop of 322, Kelley 132, Diamond M 562, and Sharon Ridge Canyon 212 psi. These are arithmetic averages from many wells, corrected to —4,300 ft. datum, but not weighted.

So what? Is Scurry not as good as reported? Poor performance? Too rapid a production rate? Waste?

Definitely not! Rather, the new data show "normal expectancy," "as expected at this point," "nothing wrong," "no damage or waste." The above features all were brought out at the Austin meeting of the commission, held the middle of this month on the Scurry fields, to review operators' testimony and field data pertaining to maximum efficient rates of production (M.E.R.) and field rules and regulations.

As a matter of fact, the testimony showed that the pressure-production data confirmed the presence of billions of barrels of oil in the Canyon reef formation. If there were less oil, the pressure drop would have been greater.

Use of engineering.—Just a few years ago, if bottom-hole pressures in a comparatively new field showed a drop of several hundred pounds, that situation was viewed invariably with great alarm by oil-company management, engineers, and state regulatory bodies alike.

The testimony presented by Scurry operators, oil-company engineers, and Austin Consultant John McQuown was a good example of the vastly improved reservoir-engineering procedures and formulas for practical purposes, that have been developed of late years.

As a result of the technical testimony presented, no one at the hearing appeared perturbed about the pressure decline. Rather, the general consensus was that the reservoir performance to date had been "as expected from production and reservoir data," and "confirming" the reserves previously calculated by volumetric means.

Material-balance calculations, data on compressibility (or expansibility) of the reservoir crude oil, and pore volume figures were the basis of the expressions that the Scurry fields were performing satisfactorily.

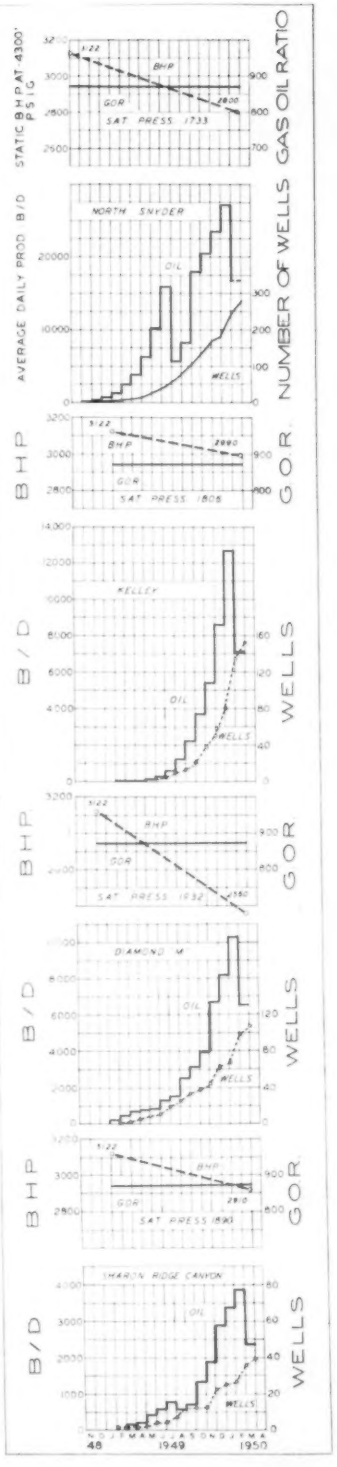
The picture was given via formulas and computations which showed that in the present preliminary production phase, the high-pressure crude oil, which is undersaturated with gas, has been producing so far merely as an "expansion" of the oil itself. Original reservoir pressure at —4,300 datum was 3,122 psig. The saturation or "bubble point" pressure, at which natural gas begins to come out of solution in the crude oil, is way down in the 1,733 to 1,932 psig. range

RESERVOIR OIL ANALYSIS—SCURRY COUNTY PENNSYLVANIA REEF FIELDS

Field—	Sharon Ridge	Diamond "M"	Kelley	N. Snyder
Reservoir temperature, °F.	128	126	127	125
Saturation pressure, psig.	1,890	1,932	1,806	1,733
Viscosity of saturated oil at reservoir temp., Cp.	0.33	0.34	0.41	0.67
Compressibility relative volume at				
3,500 psig.	979	975	976	
3,000 psig.	985		982	983
2,500 psig.	991		990	989
2,000 psig.	998	999	997	996
Flash liberation temp., °F.	76	74	70	70
Gas-oil ratio, atmos. flash	1,176	1,168	1,077	967
Formation volume, Vs/Fr	1.68	1.691	1.656	1.603
A.P.I. gravity	41.8	41.6	41.7	42.1
Composition: Mol. wt. of heptanes plus		195	192.2	190.8

CORE ANALYSES SUMMARY—SCURRY REEF FIELDS

Field—	Number wells analyzed	Number core samples	Range of porosity by wells per cent	Average porosity all samples, per cent
N. Snyder	14	3,434	3.70-14.40	8.36
Kelley	18	1,467	3.50-14.38	7.64
Diamond M	10	702	2.23-11.18	5.13
All wells	42	5,603	2.23-14.40	7.77



Opposite page: These key charts for Scurry give bottom-hole pressures, production history, gas-oil ratios, and numbers of wells. Right: Map showing subsurface top of the reef (C.I. = 100 ft.) and locations of pumping wells and those making water.

(see table). Thus, in the field no natural gas so far has become out of solution in the reservoir itself because the reservoir pressures are still in the range of 2,560-2,900 psig. (see charts).

Engineers' testimony at Austin indicated that the fields would have to be produced considerably more before conclusions could be reached as to whether the motivating force for the bulk of the reserves will be solely internal gas expansion, or in part also benefited by natural water influx. (A good many petroleum engineers believe that at least 10 per cent of a pool's oil must be produced before sufficient factors are ascertainable to determine the production mechanism.)

The Railroad Commission members were told that further pressure drop and more production would be necessary to determine potentialities of water influx, gravity drainage, intra-reservoir communication, and similar factors, in order to evaluate the best production methods and producing rates.

At the bubble point (1,733 psi.), the average compressibility factor of the crude is 1.35×10^{-5} bbl. per bbl. per psi. pressure drop. There will have been 1.89 per cent of the oil produced at the bubble point. Production from Snyder-Kelley so far represents only about 0.3 per cent of the oil in place, which is estimated to be over 2,000,000,000 bbl.

Material balance calculations indicate that a 10 per cent saturation of free gas in the reservoir's pore space is necessary before any permeability to gas will become effective. At any lower percentage, the permeability to gas would be zero. And the calculations show the 10 per cent of free gas would not exist until the B.H.P. drops to 1,400 psi.

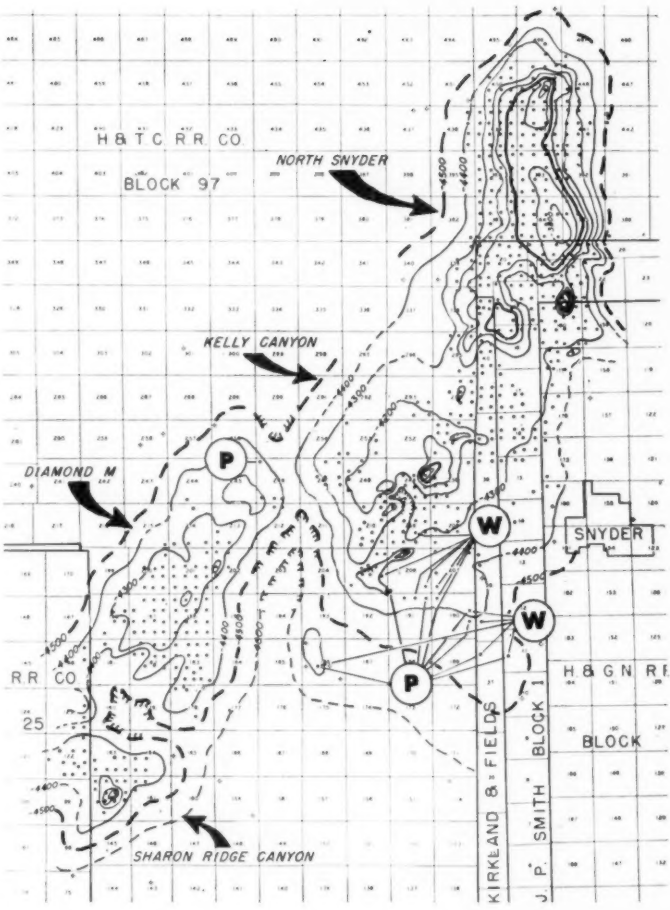
What 1,400-lb. B.H.P. means.—One engineer explained this point in terms of allowables, for an average North Snyder well (40 acres). The oil in place **per well** is about 5,000,000 bbl.

At present allowables (about 92 bbl. per calendar day), and using the 10 per cent pore space point for "free" gas permeability, approximately 15 years will have to elapse before gas starts freely to move in the reservoir. At this time over 11 per cent of the original oil in place will have been produced. Until then, the gas-oil ratio will be approximately the solution ratio, and the free gas evolved from the solution will not tend to segregate from the oil by gravity, regardless of structural conditions.

The Scurry porosity data (see table) is of interest, particularly when viewed with total producing thicknesses of various Scurry leases as reflected from the accompanying reef structure map. Water level is about —4,506 ft. The average porosity for the over-all (total) producing section is 7.7 per cent, which is excellent for limestone formations.

Most of the leases have a very thick over-all producing section.

The Scurry Canyon reef fields (North Snyder, Kelley, Diamond M, and Sharon Ridge) have produced 8,133,976 bbl. of oil and 7,076,550 M.c.f. of gas to April 1. As of the same date there were 577 flowing wells. There were only 9 wells producing on artificial lift. There were only 13 wells producing water (570 bbl. per day).



New Deep-Well Formula

AUSTIN.—A general increase in the "1947 yardstick" proration formula for wells deeper than 10,000 ft. has been announced by the Texas Railroad Commission. The amended yardstick will become effective April 1.

The new schedule calls for the following allowables on a 40-acre basis:

Depth	Allowable
10,000-10,500	230
10,500-11,000	245
11,000-11,500	275
11,500-12,000	310
12,000-12,500	350
12,500-13,000	395
13,000-13,500	445
13,500-14,000	500
Over 14,000	560

Long Lake Purchase

Byrd-Frost, Inc., of Dallas, has purchased for a cash consideration of $1,000,000 all the holdings of Tex Harvey Oil Co., Dallas, in the Long Lake pool of Anderson County, Texas.

This includes 17 oil wells and two gas wells, all producing from the Woodbine sand. Part of the oil wells are completed as gas producers.

Byrd-Frost through its subsidiaries, Inland Refining Co. and Anco Gas Co. operates a 2,500-bbl. refinery and a

gasoline plant near Long Lake pool. Production from the newly acquired properties will augment that of Byrd-Frost which is being processed at the two plants.

Scurry Plant Started

Construction on a $900,000 high-pressure, absorption-type, casinghead-gas plant in Scurry County has been started by Standard Oil Co. of Texas. Located 10 miles north of Snyder, Tex., the plant is not expected to be completed before late summer.

The unit will gather gas from all the company wells in the Snyder area via a 23-mile piping system. About 20,000,000 cu. ft. per day will be handled from which raw gasoline, butane, propane, and refined natural gas will be produced.

Imports Query

Personal appearance of 15 company presidents asked

PAMPA, Tex.—Presidents of 15 major oil companies are being asked to appear in person before the Texas Railroad Commission May 17 to submit estimates of their proposed imports during the last half of 1950.

The company executives also are asked to have with them data on the full amount of crude oil needed above ground to fill pipe lines and provide adequate storage and ample working stocks at the beginning and end of the heavy-gasoline-consuming season. Data also are being asked on gasoline and heating-oil stocks.

The request that the company heads be present at the regular statewide proration hearing in Austin was made in telegrams signed by Commission Chairman William J. Murray, Jr., and Commissioner Ernest O. Thompson.

Telegrams were sent to The Texas Co., Gulf Oil Corp., Standard Oil Co. (N.J.) Sun Oil Co., Shell Oil Co., Socony-Vacuum Oil Co., Inc., Atlantic Refining Co., Standard Oil Co. (Ind.), Sinclair Oil Corp., Continental Oil Co., Phillips Petroleum Co., Cities Service Oil Co., Standard Oil Co. of California, Humble Oil & Refining Co., and Magnolia Petroleum Co.

Thompson revealed the sending of the telegrams in a speech before the Pampa Petroleum Engineering Society. Referring to the data on crude-oil storage, he quoted the telegram as saying: "These figures are for the nation. Also we desire to know how much crude oil and products you expect to import daily average during the last 6 months of this year.

"This information absolutely necessary in order that we may gage properly the market demand for Texas crude. It is felt that this matter is of sufficient importance to our state and the nation that you be personally present to explain your company's figures on stock requirements and imports if any. We feel that we should have the opportunity to go fully into this matter with the chief executive officer of each company."

In his talk before the Pampa society Thompson said imports of crude oil and petroleum products into the United States "have lately greatly depressed the market for Texas crude." He quoted statistics that showed that the state has suffered a decrease of $19,667,031 in oil gross-production taxes for March 1949 through February 1950 compared with the previous 12-month period.

NATIONAL AFFAIRS

Loan Defended

Texmass, RFC say $15,000,000 loan backed by collateral of $48,000,000; fund to publicize company view reported

Bertram F. Linz

WASHINGTON. — The controversy over the first and only oil loan ever authorized by the Reconstruction Finance Corp. continued to seethe as officials of Texmass Petroleum Co. and the RFC defended the arrangement against attacks by a Senate subcommittee.

Property valued at $48,000,000 was posted as collateral for the loan of $15,100,000 from the RFC and two insurance companies, they said, and the RFC portion of $10,100,000 will be fully repaid within 10 years.

However, Ronnie Smith of Dallas, a Texmass director, disclosed that he and five other interests had made up a pool of $160,000 to publicize the company's side of the case, but insisted that the sum will not be reimbursed out of the proceeds of the loan. The others in this pool were named as Jack Frost, Dallas; A. W. Kincade, Wichita; Forest A. Clark and John Chase, Boston; and Republic Steel Co.

RFC statement. — Company officials held a press conference in Washington on the heels of submission to the Senate banking and currency subcommittee, which is investigating the RFC, of a full explanation by the lending agency of the steps which have been taken in the Texmass case.

That statement asserted the loan is legal in all respects, is in conformity with the spirit of the RFC Act, was approved on the basis that the collateral amply secures the loan, with no collateral value given to unproven acreage, and all of the company's income will be paid directly to RFC by the pipe-line companies as additional security.

Appended to the statement were communications from the Mercantile National, Republic National, and First National banks of Dallas expressing confidence in the loan.

Texmass view.—Smith said Texmass had gone to RFC only after futilely canvassing many sources of private capital, and a loan became necessary in the first place because of a combination of factors which included the demands of original long-term creditors who were taking 75 per cent of the gross income and leaving little or nothing for development, unsatisfactory management prior to the reorganization of a year ago, and a cutback in the allowable oil production by the Texas Railroad Commission.

Smith admitted that a substantial part of the loan will be used to bail out creditors, but said this was necessary in order to collateralize the loan and give RFC a first mortgage on all company properties which could be done only after the satisfaction of prior liens.

Declaring that the loan would be repaid within the 10-year limit placed on RFC advances, Smith declared that it may be paid off well within that period, since rehabilitation of

IN THIS ISSUE . . .

A news report on the proceedings of the three exploration societies meeting jointly in Chicago this week begins on page 106 of this issue. These are the American Association of Petroleum Geologists, the Society of Exploration Geophysicists, and the Society of Economic Paleontologists and Mineralogists.

Accompanying this report is a digest of papers presented at the three meetings, and other special material on petroleum exploration.

Also in this issue is a special section on West Texas oil. Inserted in the issue is a folded wall map of West Texas with a detailed map of the Canyon reefs in Scurry and adjacent counties, based on information supplied The Oil and Gas Journal by Southwest Mapping Co., Fort Worth.

the company's wells will increase output by 30 per cent or more. Texmass now is operating 493 producing wells, 476 of them for oil, on 20,000 acres of proved leases in six states, and holds another 2,000 acres of proved but undrilled leases with an estimated oil reserve of 14,600,000 bbl.

Smith said that RFC engineers have estimated that with a production cost of 75 cents a barrel, which is 50 per cent or more above average, and without giving any effect to the drilling of the proven acreage, only about $3,200,000 will remain unpaid at the end of 10 years, and asserted this sum could readily be covered by the return from additional development work.

Smith said that Texmass engineers estimated the company, as of last December 31, had oil reserves of 15,608,000 bbl. and gas reserves of 34,885,000 M.c.f., while RFC engineers placed the oil reserve at only 3,000,000 bbl. less.

Texmass, Smith said, expects to begin taking down the loan money on April 27, as provided for in the agreement with RFC, despite Fulbright's opposition.

The company's operational chart calls for the earmarking of $1,000,000 of the loan for new drilling on proved offset leases and $500,000 for rehabilitation of its wells.

Tidelands Action

Rayburn to seek approval of bill during this session

WASHINGTON.—Tidelands legislation was nudged further toward congressional action last week when the House judiciary committee, by a 16-10 vote, approved the state-sponsored measure dividing tidelands control between the federal and state governments.

Admittedly pleased with the action of the committee, House Speaker Sam Rayburn of Texas said an effort will be made to pass the legislation this session. Rayburn has taken a leading part in the effort to settle the controversy, raised by the Supreme Court when it ruled the federal Government had "paramount rights" in the California offshore oil fields.

The committee vote came after several weeks of meetings to consider the bill, under an agreement to pass on it April 20 regardless of whether the Supreme Court had rendered its decision in the suits against Texas and Louisiana.

The bill would restore ownership to the states of the tidelands out to a limit of 3 miles in all cases except Texas, which would be given a 10½-mile belt, with the federal Government in possession of the area between those limits and the edge of the Continental Shelf.

The states, however, would receive 37½ per cent of the royalty and other revenues from the government's area, and leases in force in that area on January 1, 1949, would be automatically renewed by the Government at a flat royalty rate of 12½ per cent.

In outline, the current legislation parallels a measure passed by Congress in 1946 and vetoed by President Truman as premature in view of the fact the issue was pending before the Supreme Court. The following June the court rendered its decision in the California case, and since then a number of efforts have been made to develop legislation which in effect would overrule that decision.

L.P.G. and Imports

Special committee tells NPC imports hurt market

WASHINGTON. — Oil imports are affecting the natural-gasoline market, the National Petroleum Council was advised at its spring meeting this week in connection with a report by a special committee on the liquefied-petroleum gas situation.

The L.P.G. report was submitted by W. K. Warren of Warren Petroleum Corp., supplementing one given the council at its January meeting, at which time the import situation was not touched upon. Since then, it was said, natural-gasoline stocks have been piling up.

On the eve of the meeting, council members and Interior Department officials concerned with oil gathered at a "get acquainted" party, which Interior Secretary Oscar L. Chapman was unable to attend because of a prior speaking commitment.

This week's council session had a brief but important program, on which discussions of the import situation, appropriations for the Oil and Gas Division, and natural gas were expected to take the spotlight.

Natural gas was to come up in connection with a report by the agenda committee on the Interior Department's request for a study of the gas supply and outlook, and it was anticipated that the President's veto of the Kerr-Thomas bill to exempt independent producers and gatherers from Federal Power Commission control would be a subject of comment.

Interior officials also were expected to talk about their problems, possibly including their views on imports, a possible study from the industry standpoint of costs of producing synthetic fuels, and the minimum-wage problem on government contracts involving petroleum.

Five new members recently appointed to the council by Chapman were expected to attend their first session: Ralph K. Davies of American Independent Oil Co., San Francisco; Warwick Downing, Denver; James P. Dunnigan, Producers Refining Co., West Branch, Mich.; Harry Leyendecker, Independent Refiners Association of America; and Sid W. Richardson, Fort Worth. An invitation to attend also was extended to Dr. Jose Martorano Battisti, top man in the Venezuelan oil ministry.

The program also called for the appearance of Undersecretary of the Treasury Edward H. Foley, Jr., to present a citation for the council's participation in the Treasury's savings-bond campaign.

Cotton Valley Decision

WASHINGTON.—The Government lost its antitrust suit against the Cotton Valley Operators Committee this week because it refused to produce confidential F.B.I. files on the case.

With Justice Tom Clark not participating, the court spit 4 to 4 on the issue and could render no decision, thus automatically affirming the action of the federal district judge who dismissed the suit.

The Government's suit was filed in the federal district court at Shreveport in June 1947, while Clark was attorney general, charging that the producers in the field who established the operators' committee had violated the antitrust law in connection with the processing of products removed from the wet gas and their joint sale allegedly through selected trade channels at fixed prices, terms, and conditions.

The operators' committee asked the court to require the Department of Justice to make available the reports, communications, etc., which the F.B.I. had gathered in preparation for the suit.

The department refused on the ground that the material was confidential, although in one of the more recent spy trials it had produced such files, and the court granted a motion of the defendants for dismissal of the suit.

GULF COAST

Louisiana Allowable Up

BATON ROUGE. — The Louisiana Conservation Commission has set production allowable of crude oil for May at 539,917 bbl. daily. This is an increase of 3,659 bbl. daily over the April figure.

Quota of South Louisiana fields was raised 4,000 bbl. to 416,617 bbl. daily, while North Louisiana allowable was cut to 123,300 bbl. daily, 241 bbl. daily below the April figure.

The estimated May output of crude oil has been set at 514,917 bbl. daily plus 37,150 bbl. of petroleum liquids other than crude oil.

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Refiners Object

New military lube-oil specifications indicate addition of another grade which must be manufactured, distributed

George Weber

THE military's new lube-oil specifications are drawing considerable criticism from the nation's refiners.

Some think the new standard of quality demanded is too high, others say it's too low, and many agree it is unnecessary.

The new specifications, announced at the recent annual meeting of the National Petroleum Association *(The Oil and Gas Journal, April 20, page 141)*, were drawn up by the U. S. Army Ordnance Research and Development Division.

In brief, the new quality standard reflects the military's belief that fuels of the future will consist primarily of cracked stocks having a wider distillation range and a higher sulfur content.

The new specifications provide that a fuel of such characteristics be used in the engine in which the lubes are being tested.

To pass minimum tests, the new grade will need to contain a higher percentage of detergency additives. It will thus reduce corrosive wear and engine deposits which result both from the use of high-sulfur fuels and from generally heavier load demand.

Extra grade?—Accepting the military's more-severe specifications with varying degrees of criticism, the refiners now raise the question whether the new grade actually will supersede the former Army 2-104B for commercial use or will constitute another heavy-duty grade which they must manufacture and distribute.

The new oil grade, termed Military Specification 2104, supersedes, so far as the military is concerned, the U. S. Army 2-104B grade which has been in use 10 years. The principal difference lies in the fuel to be used in the AXS-1551 test procedure (CRC Designation L-1). Fuels used in the old and new specification tests have the following characteristics:

	Army 2-104B	Military 2104
Distillation:		
50 per cent (°F.)		500
90 per cent (°F.)	550-600	600-640
End point (°F.)	675 max.	650-690
Sulfur, wt. per cent	0.4 max.	0.35 min.
Cetane No.	43-53	40-45

These military specifications for lubricating oils, although based on quality required only by the armed services, influence a market far greater than that for military use alone. Such standards are largely accepted and specified for use by manufacturers of gasoline and diesel engines for commercial use as well. This results in the extension to commercial operation of quality requirements considered necessary in severe military use.

In announcing the new test specifications N. L. Klein and R. E. Streets of Ordnance stated:

"The use of additives of any kind in order to produce a clean fuel or solvent treating of the fuel is not permitted. Additives to increase the sulfur content above the minimum 0.35 per cent natural sulfur specified will be permitted after approval of the additive sulfur compound by the Ordnance Department. Because of the lack of reproducibility of the bomb method for determining sulfur content, it is required that Armour Research Foundation check the sulfur content of all AXS-1551 test fuels reported at 0.4 per cent sulfur or below."

Reason for change.—The military spokesmen explained that their decision to raise the standards stemmed from the fact that fuels with which the former military oil grade performed satisfactorily during the recent war differ from those which will be available in another emergency.

Further, they pointed out, the trend in military engine design, both gasoline and diesel, is in the direction of increased severity. These factors, they said, required the raising of minimum standards.

It was pointed out that while many of the better oils graded as Army 2-104B would continue to perform satisfactorily, the oils usually obtained by the Army on competitive bidding were unfortunately those of lower quality, meeting the minimum standards for that grade.

The military spokesmen summarized by stating that it is considered that the new grade represents a reasonable compromise between gasoline and diesel-engine requirements and wartime availability, rather than the best answer to any single requirement.

Reevaluation under way.—Refiners are now reevaluating their heavy-duty oils (10, 30 and 50) to conform to the new test specifications. Some of the higher-quality oils designated 2-104B will qualify without change.

For example, of the first 24 oils thus far reviewed, 15 were approved. Three of the 15 were the same oils sold under the superseded specifications. The new lube grade will differ mainly in providing higher detergency and thus must sell at a higher price.

What refiners say.—Criticism from the refining industry voiced at the N.P.A. forum and elsewhere stated variously that the new specification was (1) too high, (2) too low, and (3) unnecessary. Ordnance was taken to task by one major-company representative for setting the new grade without evident data to support either its necessity or its guarantee of satisfaction.

In view of the fact that the military decision is made and the specification set, others in the industry deplore unconstructive criticism and advocate getting down to work at trying to simplify the heavy-duty-oil field, which at present includes four grades: Army 2-104B, Military 2104, and two so-called "super duty" grades, Supplement 1 and Supplement 2.

Supplements 1 and 2, containing respectively about twice and four times the amount of additives found in 2-104B, were developed by the industry to meet some extremely severe commercial applications, principally in diesels using high-sulfur fuels.

How many grades?—Originally, the conception of the new military grade was that it might consolidate the 2-104B and Supplement 1 grades, reducing the number of heavy-duty oils from three to two. This simplification is not now indicated. The reverse, in fact, appears possible—retention of the superseded military grade for commercial use, both Supplements 1 and 2, plus the new military grade.

Despite the fact that the military is dropping the old specification, there are good arguments for its continuance. These come from commercial users, who in many cases find the grade entirely satisfactory and object to paying more for the new higher-additive, heavy-duty grade.

The continuance of four heavy-duty grades is regarded by many refiners as unnecessary, posing uneconomic manufacture and distribution and storage problems.

Three solutions may be presented. The new Military 2104 may eventually replace Supplement 1, as the spread in oils of the two grades will bring some duplication in quality. Or a compromise grade between Supplements 1 and 2 may be substituted for those two grades. The third possibility, that the former and less expensive Army 2-104B be dropped for the new grade, is regarded by some as least serving the interests of the consumer, since the former of the two military grades adequately meets a wide market at lower cost.

Gas-Liquids Problem

Need for new uses cited before annual N.G.A.A. meeting; direct sales threaten gasoline market, Carney cautions

Kenneth B. Barnes and Roy F. Carlson

FORT WORTH.—Problems of finding adequate market outlets for the volume of natural-gas liquids now being produced dominated the discussions at the annual convention of the Natural Gasoline Association of America here April 24-26.

Papers on storage, conservation, employe training, corrosion, and testing methods completed the formal program, and the convention ended with the annual "Information Please" session Wednesday at which a wide variety of questions was tossed at a panel of experts.

Gasoline - market effect. — A veiled threat that the gasoline market may be demoralized by direct sales of natural gasoline as motor fuel unless refiners use more gas liquids in their finished gasoline was made by B. R. Carney of Warren Petroleum Corp., Tulsa.

The percentage of natural-gas liquids marketed directly as motor fuel increased from 8.2 per cent of the total in 1948 to 9.4 per cent in 1949, he said, while the volume used as refinery raw material declined from 64.0 to 62.5 per cent.

"It is believed that there will always be some proper direct market outlet for natural-gas liquids, but it also appears that too large a portion of these going directly to market can create chaotic conditions for all motor fuel," Carney said.

"In the long run it is felt that a proper balance will be obtained if about 70 per cent of available natural-gas liquids moves to markets through refiners. This means that at present refiners should plan to make up about 6.5 per cent of their raw material from natural-gas liquids and should look forward to using approximately 9 per cent, that is, 70 per cent of the natural-gas liquids available.

"If the refiners cannot do this, then our natural-gas liquids will more and more seek direct market outlets at whatever prices they can command. When this happens we will indeed find out just how important octane is. Is is the author's guess that a 2 or 3-cent price differential at the filling-station pump can offset quite a few octanes with quite a number of motorists."

Natural-gas liquids are not getting their fair share of the market, Carney insisted. He pointed out that they represent 13 per cent of the nation's petroleum reserves but only 9 per cent of production and 8.4 per cent of consumption.

Largely through the efforts of state conservation authorities, Carney said, the recovery of natural-gas liquids has increased 21 per cent since 1946 and now is 1.19 gal. per M.c.f. of gas produced as against .98 gal. in 1946. But he added the warning:

"There is no conservation agency quite as effective as a good price. Whether conservation can continue to grow under present market conditions is indeed a question."

New market.—A huge potential market for liquefied petroleum gas lies in the 10,000,000 to 12,000,000 suburban and farm homes not now using any form of gas, it was declared by Kenneth W. Rugh of Phillips Petroleum Co., Bartlesville.

The expansion of the gas-utility industry, which has been accelerated by the extension of large transcontinental transmission lines, will eventually have the effect of increasing the demand for L.P.G. by the gas utilities, Rugh said, but added that a relatively small liquid storage of L.P.G. at the terminus of the gas transmission lines represents a huge reserve storage of gas to augment the supply brought through transmission lines during the peak periods.

While the natural-gas industry has doubled the number of its domestic customers and increased its sales 2½ times during the past 10 years, Rugh said, the L.P.G. industry has increased the number of its customers 8 times (from 800,000 to 6,500,000) and its total sales 12 times (from 223,000,000 to 2,725,000,000 gal.).

The fluctuations in oil production and proration orders is virtually forcing gas-transmission companies to install dual facilities, it was declared by Paul Kayser, president of El Paso Natural Gas Co., El Paso, Tex.

He explained that in order to avoid waste his company must install gathering facilities to take all casing-head gas which may be offered at peaks of oil production, and at the same time have natural-gas reserves and facilities to supply contract demands whenever flare gas is unavailable.

The worst part of this, he said, is that flare gas usually is offered in greater quantities in the summer when the transmission company's demand is lowest, and is apt to be shut in during the winter when the demand for gas is the highest.

Kayser offered no easy solution to this problem, but asked for cooperation from oil producers and state proration authorities.

In addition to changes in over-all state oil allowables, Kayser said that serious problems arise from the complete shut-down of many oil wells toward the end of each monthly proration period. Another is the practice of delivering little or no oil-field gas at night but putting huge quantities into the line in the morning, giving the El Paco company a fluctuation from night to day of as much as 60,000,000 cu. ft. He asked that oil producers arrange a more even producing pattern in order to minimize these problems.

Hanlon Award

Dr. Katz presented highest N.G.A.A. award at meeting

FORT WORTH. — Dr. Donald L. Katz, professor of chemical engineering at the University of Michigan, was given the 1950 Hanlon Award at the meeting of the Natural Gasoline Association of America here April 25.

The award was made for his research on phase behavior of hydrocarbons and on critical phenomena and retrograde condensation, and for his contribution to the natural-gasoline and cycling industries in supplying basic information to guide engineers in the design and operation of plants.

DR. DONALD L. KATZ

The award, highest honor in the natural-gasoline industry, was established by E. I. Hanlon, chairman of the board of the National Bank of Tulsa and a pioneer in the natural-gasoline business. The presentation was made by James E. Pew of Sun Oil Co., Philadelphia, president of N.G.A.A.

Dr. Katz was educated at the University of Michigan and has been on the faculty there since 1931 except for 3 years when he developed a research program on oil and gas production for Phillips Petroleum Co. in Bartlesville. He is the author of more than 90 technical papers and reports,

and has served as consulting engineer for many companies and government agencies.

Dr. Katz' reports on phase behavior of hydrocarbons have been of great assistance in understanding separation processes and reservoir behavior, Pew stated in presenting the award, continuing:

"His publications on critical phenomena and retrograde condensation helped materially to clarify a complex subject for industry. Meter factors which he developed for condensate-bearing gases simplified meter calculations for the cycling industry, and his published data on natural-gas hydrates led to methods of predicting conditions which could result in the stoppage of gas flow.

"Other valuable contributions resulting from his studies include papers on oil and gas reserves, viscosity of natural gases, surface tension of crude oils under reservoir conditions, heat transfer, and the water content of high-pressure hydrocarbon fluids."

Microwave Study

Joint meeting of electrical groups hears of economies of new communication systems; Humble project announced

Leigh S. McCaslin, Jr.

HOUSTON.—Microwave radio relay systems for the oil industry were the main topic of discussion here last week at the twenty-second annual conference of the Petroleum Industry Electrical Association and the Petroleum Electric Supply Association.

M. G. Staton, of Radio Corp. of America, told the oil and electric men that, in a nutshell, a multiplex microwave radio relay "can provide all the facilities of a conventional pipeline aerial wire-line system with improved reliability at a lower cost per year."

Elaborating on the economy of the new communication method, L. W. Goostree, Jr., of General Electric Co., said the microwave facilities "may be amortized over a 5-year period including all costs such as maintenance and power at a lower price than two leased wire circuits for the same period."

New project.—While the meeting was under way, Philco Corp. announced that it had been awarded an order to supply Humble Pipe Line Co. with microwave equipment for a new communications relay system 400 miles in length.

The system will parallel Humble's pipe line from Houston to Kemper, Tex. Initially it will provide eight voice circuits and a combination of teletype, and telemeter circuits.

In announcing the new Humble installation, Philco predicted that such microwave relay systems, employing many radar principles, "may eventually replace overhead wires for long-distance telephone and telegraph communications." The company added, "Not only is the initial cost of the beamed radio relays less—about $400 per mile as compared with $1,000 or more per mile for conventional pole-and-wire lines—but also these microwave systems assure savings in operation, require less maintenance and are more reliable in stormy or windy weather."

Shown here are new officers elected at the joint meeting of the Petroleum Industry Electric Association and Petroleum Electric Supply Association, held last week in Houston. Left to right are A. L. Stegner, Tennessee Gas Transmission Co., Houston, vice president of P.I.E.A.; M. L. Kennard, Gulf Coast Electric Co., Houston, president of P.E.S.A.; and V. J. Sittel, Stanolind Pipe Line Co., Tulsa, president of P.I.E.A.

Rapid adoption.—The pipe line industry has adopted microwave communications on a large scale in recent weeks. Two weeks ago, Mid-Valley Pipeline Co. announced plans for building a $750,000, 900-mile microwave system to serve its 1,000-mile crude-oil line now being laid from Longview, Tex., to Lima, Ohio. The system was engineered for Mid-Valley by Motorola Corp., and is scheduled for completion late this summer.

A week earlier, Transcontinental Gas Pipe Line Corp. disclosed that it had awarded a contract to General Electric Co. to provide microwave for its 1,800-mile system which is under construction between Mercedes, Tex., and New York City. Transco's microwave system will cost $1,500,000 and is to be completed November 15.

System described.—A description of a multimicrowave radio relay system was given by Staton in his paper before the Houston group, in which he said:

"First, microwave equipment is that type of radio equipment peculiar to the highest end of the radio frequency spectrum. As we go higher and higher in the radio frequency spectrum the radio wave exhibits characteristics more and more like those of visible light. Such characteristics, namely: diffraction, refraction, reflection and obstruction, become more and more evident at microwave frequencies.

"Second, a microwave radio relay system can be described as a series of microwave radio equipments located at fixed positions along, we will say, a gas pipe line. These equipments provide a fixed communication system along the pipe line much like that of a pole line carrying wires.

"Third, by multiplying the microwave radio relay system we can permit a number of conversations and other functions such as facsimile, teletype, telemetering, and supervisory control to be carried simultaneously over the same radio circuit without objectionable interaction or interference with each other."

New officers.—Registration at the joint electrical meeting was 480. V. J. Sittel, Stanolind Pipe Line Co., Tulsa, was elected president of the P.I.E.A. Other officers elected were A. L. Stegner, Tennessee Gas Transmission Co., Houston, vice president, and W. H. Massey, Interstate Oil Pipe Line Co., Shreveport, secretary-treasurer. New members of the P.I.E.A. board of directors are H. G. Pegues, United Gas Pipe Line Co., Shreveport, and A. F. Harrel, Continental Pipe Line Co., Ponca City, Okla.

M. L. Kennard, Gulf Coast Electric Co., Houston, was named president of P.E.S.A. Other officers are Howard Housely, Automatic Electric Sales, Dallas, vice president, and E. N. Jolliff, Crouse-Hinds, Dallas, secretary-treasurer.

Rewards of Wildcatting
WHEN the wildcatter strikes it rich, he's glad he used Youngstown. Tried and trusted, this top quality pipe is a true friend--dependable no matter what. Youngstown Oil Country Tubular Goods--drill pipe, casing, tubing,--will help realize the rewards of wildcatting.
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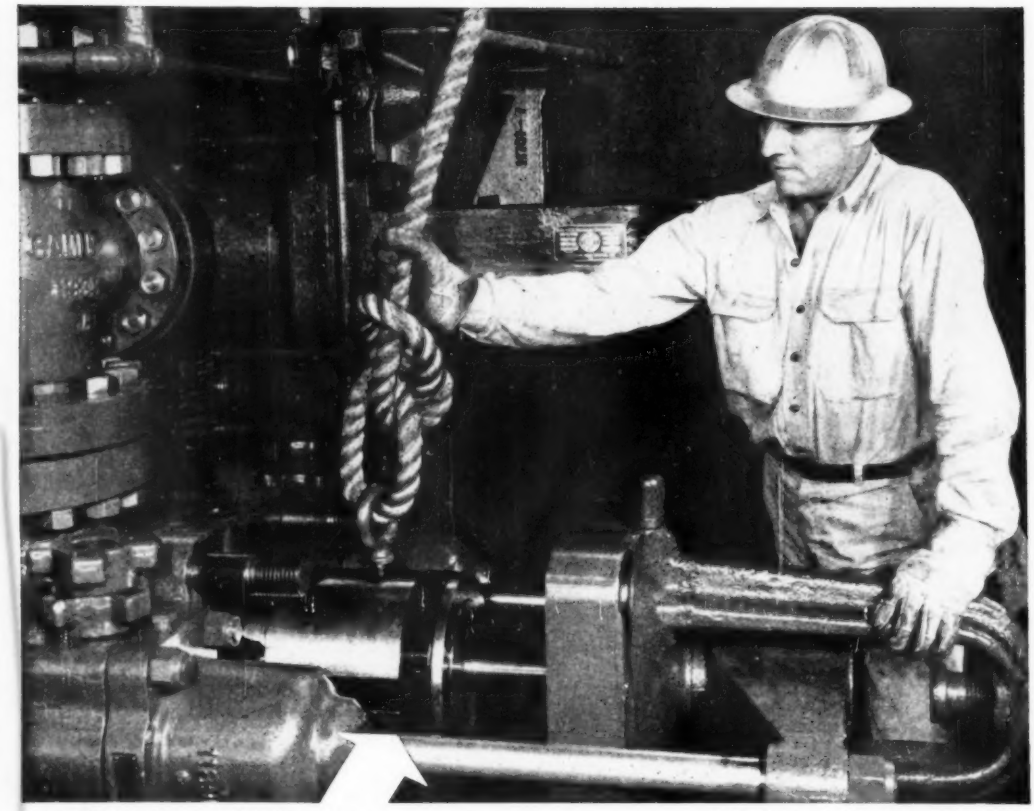

Drilling Control Unit by Cameron Iron Works, Houston, Texas *Molded Hycar parts by Murray Rubber Co., Houston, Texas*

How HYCAR sits tight on a volcano

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Record Gasoline Taxes

Rates in United States now average 5.11 cents per gallon; 1949 was record year with 16 states levying new taxes

Dahl M. Duff

THE year 1949 gained the questionable distinction of breaking all records in the imposition of additional state taxes on the petroleum industry's top product, gasoline.

Sixteen states participated in the gasoline-taxing spree last year, and in 14 of these the increases have gone into effect. The net result has been to raise the average state gasoline tax to a new high of 5.11 cents a gallon.

Of the other two states, Missouri in a referendum early this month turned down a proposal to double its 2-cent tax. North Dakota's 2-cent increase has been suspended pending a vote in June.

Activity for higher gasoline taxes will be in a lull during the remainder of this current off-year for the biennial state legislatures. It will be resumed, however, in 1951 when at least 15 other states are expected to consider further increases in their legislatures.

What it means.—The stake of the petroleum industry in this situation is tremendous. The needs of an adequate and uncongested highway system are not opposed, but statistics show that an ever-growing proportion of state gasoline-tax collections are going back to local government units for thoroughfares that have traditionally been financed by local taxation.

Additional gasoline taxes usually react to the discredit of the petroleum industry. The large segment of uninformed public is critical of a high pump price for gasoline without realizing that approximately a third of the present charge is in the tax.

States involved.—In addition to the North Dakota referendum, another popular vote on a higher gasoline tax will be held in Nebraska in November. The 1-cent increase is being collected in the meantime. In New Mexico, a proposed referendum on the increase was defeated in the courts.

The 1-cent increase approved last year in Oklahoma, Georgia, Kansas, North Carolina, and Pennsylvania are temporary. Oklahoma, incidentally is the only state shown to have made a reduction in gasoline tax since the war. This was, however, the scheduled expiration of a temporary wartime increase.

The 1949 increase in Nevada represented the replacement of an optional 1½-cent county tax with a 2-year ½-cent mandatory and a 1-cent optional county tax collected by the state.

In all, last year there were a total of 69 bills to increase gasoline taxes introduced in the legislatures of 34 states. They were rejected in 18 states. Left unaffected was Louisiana with its 9-cent tax, the highest in the nation. The Missouri referendum continues the country's lowest tax of 2 cents, although new efforts to raise the Missouri rate are expected again next year.

In addition to the 16 increases voted in 1949, two states thus far this year have initiated increases which are now pending. They are Mississippi, with a 1-cent increase, and South Dakota with a 2-cent increase. South Carolina and Massachusetts may act on increases later in the current year.

The present 5.11-cent-a-gallon figure for the average state gasoline tax compares to 4.80 at the beginning of 1949. The upward trend of the gasoline tax is shown below (figures as of the beginning of the year):

Year	Average tax (cents)
1936	4.26
1941	4.36
1942	4.41
1943	4.43
1944	4.43
1945	4.43
1946	4.51
1947	4.55
1948	4.71
1949	4.80
1950	5.11

Another campaign for more gasoline tax money will be made in 1951. States where strong efforts will be

	Tax rates (cents per gallon) imposed during 17 years since January 1, 1933																	Tax rate as of Apr. 1, 1950 (cts.)	Net tax receipts for 1948 (000)
States—	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49		
Alabama																		6	$28,238
Arizona																		5	9,385
Arkansas		½																6½	19,908
California															1½			4½	127,177
Colorado															2			6	18,377
Connecticut			1												1			4	17,126
Delaware			1														1	5	2,937
Florida																		7	44,454
Georgia																	1	7	36,674
Idaho													1					6	9,441
Illinois																		3	52,020
Indiana																		4	35,599
Iowa													1					4	24,446
Kansas														1			1	5	20,223
Kentucky																2		7	28,778
Louisiana				2												2		9	33,761
Maine															2			6	11,849
Maryland															1			5	20,064
Mass.																		3	23,922
Michigan																		3	42,463
Minnesota					1			—1	1								1	5	25,793
Mississippi																		6	20,395
Missouri																		2	17,623
Montana																	1	6	7,463
Nebraska					1												1	6	18,206
Nevada																	1½	5½	2,507
N. H.																		4	4,564
N. Jersey																		3	28,606
N. Mexico																	2	7	8,418
New York			1	—1	1													4	81,291
N. Carolina																	1	7	42,476
N. Dakota							1										2	4	5,341
Ohio																		4	69,800
Oklahoma									1½				2		—2		1	6½	26,486
Oregon	1																1	6	20,952
Penna.			1														1	5	78,525
Rhode Is.					1										1			4	5,775
S. Carolina																		6	22,052
S. Dakota																		4	6,642
Tennessee																		7	37,195
Texas																		4	73,724
Utah																		4	7,045
Vermont															½		½	5	4,124
Virginia														1				6	36,830
Wash.																	1½	6½	27,892
W. Virginia					1													5	15,974
Wisconsin																		4	29,170
Wyoming																		4	4,748
D. of C.										1					1			4	6,514
Total	1	1	4	1	5	0	1	0	2	1	0	0	3	2	8	2	14	5.11	$1,342,973

This table shows the history of the gasoline tax by states over the last 17 years. The figures in the center columns represent tax increases. The three decreases are noted with the minus sign.

On the bottom line are the total number of states making increases in each particular year. The last figure in the total tax rate column is the nonweighted national average. No increases were placed in effect the first 3 months of this year except the 1-cent raise in North Carolina effective January 1.

The 1948 motor-fuel tax receipt totals by states are the latest officially available. The estimated total of state receipts from motor fuel (net after refunds) for 1949 is $1,454,000,000. Figures in the table do not include the 1½-cent federal gasoline tax. Table is based on data of the American Petroleum Industries Committee.

made for increases next year are: Illinois, Alabama, Indiana, Arkansas, Connecticut, Michigan, New Hampshire, Ohio, Texas, Utah, West Virginia, Wisconsin, and Wyoming. There is some possibility of a decrease in New Mexico and Delaware.

The record on diversion of gasoline taxes to nonhighway purposes is better. In 1938, about 15.7 per cent of collections were diverted. This had fallen to 6.4 per cent by 1948, and it is estimated to have remained about the same through 1949. Constitutional amendments have halted this practice in some states. New York State accounts for about half the present total now being diverted.

Nor does there appear to be any increased amount of gasoline taxes being levied by localities. Special local taxes on gasoline continue in some seven states. Alabama heads the list. In that state, special gasoline taxes are collected by 191 local government units.

What's being done.—Petroleum along with other affected groups such as the highway users associations have continually fought for reduction or elimination of the 1½-cent federal tax on motor fuel which was imposed during the war with other special excise levies. However, the prospects that the federal Government can be induced to give up this prolific revenue-yielding source in the near future are not considered good.

Meanwhile, efforts to combat unjustified increases in state taxes continue. Work along this line is being done by the various state petroleum industries committees and interested local highway users groups.

Agitation for heavier gasoline taxes stems largely from two sources, public officials and the road-building groups. Opposition to their proposals in many states has been on grounds that the program was in excess of actual needs and that existing tax revenues were sufficient.

Refinery Strike Situation

Three refineries of The Texas Co. remained closed due to strikes last week, although workers returned to two additional plants pending union-company negotiations. Elsewhere on the refinery-strike front, one union was being sued by its own members and three Pennsylvania area refineries were still closed due to labor-management disagreements.

The Texaco strike situation on April 24 was as follows:

Casper, Wyo.: Work resumed April 20 following union-company agreement; negotiations under way. (Refinery capacity, 12,000 bbl. daily).

Lawrenceville, Ill.: Work resumed April 14 without a contract. Plant now on stream while negotiations progress between union and management. (Refinery capacity, 27,000 bbl. daily).

Lockport, Ill.: Workers offered to return to work; union would not guarantee against another walkout; company refused to open the refinery. Texaco has filed suit in Chicago for $1,105,000 damages against Local 222, Oil Workers International Union, the international union, and officers in connection with the strike. (Refinery capacity, 60,000 bbl. daily).

Port Neches, Tex.: Company filed $500,000 suit against O.W.I.U. and Local 228, alleging violations of agreements. Plant still shut down. (Refinery capacity, 40,000 bbl. daily).

Port Arthur, Tex.: Refinery closed. No progress made in negotiations. (Refinery capacity, 190,000 bbl. daily).

In Houston, 86 former Mathieson Chemical Corp. employes filed a $651,681 damage suit against their own union, alleging mishandling of a strike at the Mathieson plant last year. The strike started August 2 and ran until the middle of October. The petition charges union officials of O.W.I.U. suppressed an invitation by plant management on August 6 for employes to return to work, and the group is suing for loss of past and future wages resulting from the strike.

No substantial progress has been made in negotiations between labor and management in the 5-week-old strike of three Quaker State Refining Corp. plants in Pennsylvania and West Virginia. The plants affected are in Oil City and Emlenton, Pa., and St. Marys, W. Va.

Phillips Hearing Delayed

WASHINGTON. — Hearings on the natural-gas operations of Phillips Petroleum Co. which were scheduled to open in Bartlesville, Okla., May 1 have been postponed until May 15, it was announced this week by the Federal Power Commission.

The commission explained that members of the staff assigned to the case are engaged in other proceedings that prevent their appearance at Bartlesville next week.

Oil-Heat Outlook

Strong competition from natural gas expected, and Hope tells oil-heat men strong sales program will be needed

Dahl M. Duff

PHILADELPHIA. — An aggressive, strong sales program is necessary for the continued prosperity of the oil-heating business in the Northeast which now faces its first real competition as a result of natural-gas expansion, Stanley C. Hope, president of Esso Standard Oil Co., told the Oil-Heat Institute of America here this week at its twenty-seventh annual convention.

Hope said the heating-oil business is today in a healthy condition but that its supremacy in the East Coast automatic burner market will be seriously challenged by the new competitor. The Eastern Seaboard is the most concentrated fuel market in the country, with approximately two-thirds of the 4,500,000 domestic oil burners in the United States located in this section.

Oil's advantages.—"Let's have confidence in ourselves and in what we offer the public," the Esso president said. "Perhaps there is no area in the United States where natural gas has more competitive advantage over fuel oil than in some states of the Middle West. . . .

"Yet during 1949 the Midwest gained 19 per cent in oil-burner installations, against 13 per cent for the country as a whole. What better proof do we want that oil heat can stand on its own feet and grow against any type of competition—gas or any other fuel."

Speaking on the opening day of the convention, A. T. Atwill, president of the institute, predicted sales of oil-heating equipment will pass the 700,000-unit mark this year and possibly go as high as 750,000. Basing his prediction on first-quarter sales returns, and other favorable market conditions, Atwill said that from all indications, 1950 would be the best "normal" year in the history of the heating-equipment industry.

Supply problem.—In a talk on "Heating Oils of 1950," G. E. Evans, of the engineering division of the marketing department of Esso Standard, reviewed the development of catalytic cracking and discussed refinery economics of fuel-oil production. Oil which formerly found its way into oil burners with thermal cracking now ends up in automobile engines, he said, and furthermore, catalytic cracking has brought about a trend toward lower gravities of No. 2 and a slightly higher 10 per cent point.

He pointed out there are three ways of meeting the heavy winter peak load in the oil industry resulting from fuel-oil demand. One is additional refining capacity which would remain virtually idle in the summer; another would be shifts in yields, but this is limited. The third method is to build up heating-oil inventories in summer. "This requires plenty of storage, but the investment country-wide would come to less than $100,000,000, or less than 10 per cent of the cost of doing the job with reserve capacity in the three functions of producing, refining, and transportation," he said.

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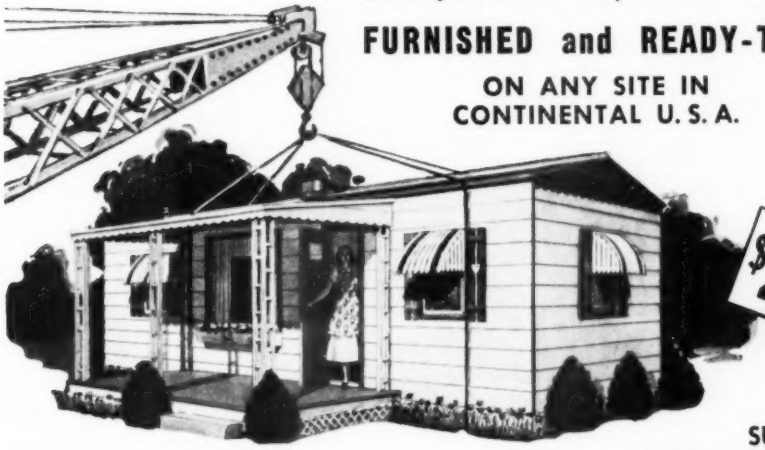

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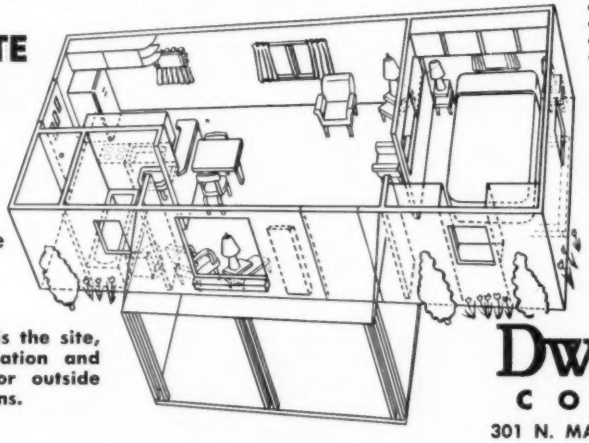

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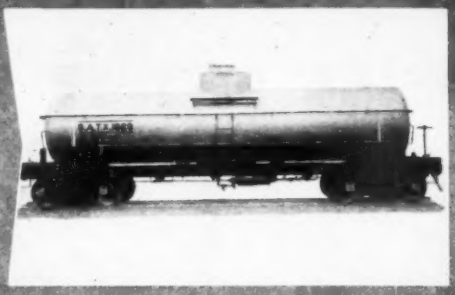

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Buyers' Market

Transition complete, A.P.I. marketing men told; companies advised to sell the oil industry along with its products

C. O. Willson

KANSAS CITY, Mo.—The petroleum industry from refinery to consumer sales is operating in a "buyers' market" not only in finished products but also from the standpoint of public approval of its way of doing business. Everyone connected with marketing has the duty of selling both the products of his employer and the progressive, competitive character of the oil industry which he also represents.

The various phases of this dual position of the distributing branches of the oil business bobbed up frequently at the 2-day meeting of the marketing division of the American Petroleum Institute held here April 24 and 25.

Speakers emphasized that the transition from a sellers' market during the war and the immediate postwar period to the more normal situation in which there is competition in every sale and in every service is now complete and continued success for all classes of sellers lies in more efficient operations.

Other speakers stressed the fact that the success of the oil industry's public-relations program now largely stems from those who distribute its products. Refiners, jobbers and dealers were urged to so conduct their affairs that they would do their essential part in maintaining sound relations with the public and aid in combating trends in our political and social life which are antagonistic to the continuance of our free enterprise system.

In addition to the consideration of developments of general importance in marketing, committee meetings and one general session were devoted to specific problems. Special attention was given to lubricating oils, including an advertising program for passenger-car lubrication. Other matters discussed had to do with manpower, inventory control, accounting, building codes, and the special needs of aviation customers.

Approximately 250 members attended the 2-day meeting. J. Howard Marshall, president of the Ashland Oil & Refining Co., Ashland, Ky., and vice president of the A.P.I. in charge of the marketing division, presided at the general sessions.

Jobbers viewpoint.—The necessity at all times of a common understanding between supplier and independent jobber based on mutual confidence was explained by **John L. Bero, veteran** independent jobber of Minneapolis, who is president of the Northwest Petroleum Association and chairman of the National Oil Jobbers Council.

In a well-received address, Bero explained the part that the independent jobber has played in perfecting the oil industry's marketing program. They have, he said, pioneered most of the practices now accepted as part of the petroleum merchandising.

J. H. MARSHALL

Bero suggested the ending of several practices by suppliers as desirable in establishing better relations. He criticized the practice of some suppliers in "throwing their weight around competitively." He disliked the practice of suppliers selling to commercial accounts on a basis equal to or less than the jobber's cost.

In regard to the problems of oversupply, Bero suggested better control of the unprocessed as well as the processed petroleum. Margins, he said, should take into consideration increased costs.

Common denominators.—R. F. Baity, vice president in charge of sales for Standard Oil Co. (Ind.), defined the common denominator as the need for "promoting our successful business system—and making it even better."

Baity explained the workings of competition in the 11 middle western states in which his company markets which had resulted in its share of total sales decreasing from 85 per cent in 1902 to less than 20 per cent today.

With a background of recent surveys of public opinion regarding the oil business, Baity explained how distrust regarding its operations was often deliberately promoted by its enemies. These actions include unsubstantiated charges of monopoly, high profits, and holding back new developments.

Lubricants distribution.—After pointing out that lubricating oils are underpriced in the sense that the increase in price of 15 per cent is far less than the increase in other commodities, a reflection of inflationary trends, W. H. Garbade, president of Deep Rock Oil Corp., Tulsa, suggested several economies. His remarks indicated that there was little probability of higher prices because of the large increase in supplies.

Garbade said that lubricating-oil sellers in getting away from "horse and buggy methods" might use the services of competent industrial engineers. One of the possible economies that he outlined was the use of nonreturnable containers for the drum shipments of lubricants.

Continued improvement in quality of products and the maintenance of the oil industry's outstanding service to its customers are only possible if there are adequate profits in markets, R. W. McDowell, president of Mid-Continent Petroleum Corp., Tulsa, told more than 300 members and guests of the Kansas City Oil Men's Club at a luncheon meeting April 24.

McDowell said he welcomed the return of plentiful supply and aggressive competition in marketing as a desirable basis for our oil economy. He deplored the fact that some of the competition had failed to meet the requirement that it be clean, intelligent, and nondestructive. He said that too much attention is being paid to expansion and not enough to profits with a resulting threat to quality and service.

McDowell also made a strong plea for support of the oil industry's public-relations program as one of the guarantees that oil marketing will continue to be freely competitive.

NEXT WEEK

TRANSCO: The complete story of longest pipe line in the world, the 1,832-mile, 30-in. gas pipe line being constructed by Transcontinental Gas Pipe Line Corp. from the Southwest to the Mid-Atlantic Seaboard. Nine authors have contributed to this special section, each dealing with a specific subject. The firm's president, Claude A. Williams, presents the over-all picture, while other officials of the company describe such features as gas-compressor station and dehydration-plant design, pipelaying methods, double-jointing procedures, valving design, river crossings, measurement and pressure control, and eastern section construction. Then there is also a story on the contracting firm.

NATURAL-GAS UTILIZATION for conversion into nitrogenous fertilizers is the subject of an article by two authors with Phillips Chemical Co.

NATURAL-GAS ECONOMICS, with statistics and discussion by the Journal's statistical editor, with latest information on production and reserves.

KNOCK RATINGS: Three authors discuss road vs. laboratory knock ratings, and describe equipment used in making the tests reported on.

$12,000,000 Plant

Gasoline plant to handle 600,000,000 cu. ft. of natural gas daily, produce 400,000 gal. of products to be built

Leigh S. McCaslin, Jr.

HOUSTON.—A large natural-gasoline plant coupled with a new petrochemical plant will be constructed in western Kentucky to process gas moving through the main transmission line of Tennessee Gas Transmission Co.

Announcement was made jointly by Gardiner Symonds, president of T.G.T., Houston, and Thomas S. Nichols, president of Mathieson Chemical Co., Baltimore.

Tennessee Gas will build and operate a $12,000,000 extraction and recovery plant on its line near Greensburg, Ky., about 12 miles from its No. 12 compressor station. It will process initially about 600,000,000 cu. ft. of gas daily and produce approximately 400,000 gal. daily of liquid hydrocarbons consisting of ethane, propane, butane, and natural gasoline.

The liquid-hydrocarbon stream from this stripping plant will be carried through an 8-in. pipe line to a $17,000,000 petrochemical plant to be built at Brandenburg, Ky., on the Ohio River southwest of Louisville. This plant will be built and operated by Mathieson Hydrocarbon Chemical Corp., a new $27,000,000 concern formed by Mathieson Chemical and stockholders of Tennessee Gas.

The new company also will build a $6,000,000 plant for the production of raw-material components at another location. Details of the processes and products of these two plants have not been revealed.

In commenting on the new company, Nichols said:

"This development marks the entry of Mathieson Chemical Corp. into the important and growing field of petrochemicals. Already an important factor in the alkali, chlorine, nitrogen, and fertilizer industries, Mathieson will now further diversity its production and markets.

"The decision to build the plant on Tennessee's pipe line in Kentucky assures the company of a large volume of low-cost raw materials for a long term, and at a point close to the principal markets for the chemicals it will produce."

Of particular interest is the fact that this stripping plant will be located near the consuming end of o gas-transmission line. The usual practice has been to extract liquid products before natural gas is put into a long-distance line, with the result that the bulk of the production of natural gasoline and liquefied petroleum gas is in areas of oil production.

Engineers for Tennessee Gas pointed out that the stripping plant will serve to remove objectionable liquids that have formed in some of the distribution lines of its customers while at the same time utilizing valuable hydrocarbons previously unused in the natural gas. Removal of the hydrocarbons will not appreciably reduce the heating quality of the natural gas, they said.

It is anticipated that construction will start within approximately 2 months and that the plant will begin operation in the summer of 1951. A low-temperature separation process will be utilized in the stripping plant.

J. J. King, chief engineer of Tennessee Gas, said the western Kentucky location was selected because of freight-rate advantages.

The stripper plant will remove around 15 to 20 per cent of the ethane in the gas processed and substantially all of the propane and heavier hydrocarbons, King stated.

Quite a bit of the gas coming into Tennessee Gas' lines from the supplying fields has already been processed through an absorption plant. Figures as to the exact percentage that is processed in this manner are not readily available. Additional liquid hydrocarbons are removed at the various compressor stations along the line. However, no great difficulties have been occasioned in the transmission line because of liquid hydrocarbons.

The stripper plant is not large enough to process all the gas that will be passing through the line by the end of the year. The company's 1950 construction program will raise the capacity of the system to 1,060,000,000 cu. ft. daily. However, the plant is being designed so that it can be expanded, if desired.

Cities Service Change

Cities Service Co. is preparing to divest itself of the last of more than 40 utility-industry subsidiaries once controlled by the company.

With this step, Cities Service will be engaged entirely in oil and natural-gas operations. The divestment of the utility subsidiaries has been carried out in compliance with the Holding Company Act passed 15 years ago.

It was disclosed last week in New York's financial district that Cities Service is preparing to distribute to its stockholders 3,702,000 shares, or 98½ per cent, of Toledo Edison Co. The plan for the distribution has been filed with the Securities and Exchange Commission which administers the Holding Company Act.

Before the divestment Cities Service was a major entity in the electric-utility and bus and trolley field. As an oil company, its gross operating income last year was $582,560,721 with a gross production of 38,168,000 bbl. and natural-gas sales of 429 billion cubic feet.

MEETINGS

Compact Spring Meeting

Conservation in the public interest is the theme of the spring meeting of the Interstate Oil Compact Commission in Biloxi, Miss., May 4-6.

The principal address on this subject will be by Robert B. Anderson, independent producer of Vernon, Tex., president of the Texas Mid-Continent Oil and Gas Association, and prominent in many activities concerned with the public interest.

Three state governors are also on the program. Gov. Roy J. Turner of Oklahoma will preside as chairman of the commission, Gov. Fielding L. Wright of Mississippi will give the address of welcome, and Gov. John W. Bonner of Montana will respond with a discussion of petroleum resources in his state.

Particular interest will lie in the reports of several committees. The legal committee will present the final form of a proposed model state statute for oil and gas conservation. The engineering committee will present a new book on engineering principles of conservation. The regulatory-practices committee will have a study on the pressure base for measuring gas in various states. The research and coordinating committee will report on controlling factors in well spacing. State reports on reserves will be presented by the stripper-well and secondary-recovery advisory committees.

Other features on the program will be a special report on Kansas conservation, by Jeff A. Robertson, chairman of the Kansas Corporation Commission; and a paper on underground gasification of coal by Dr. Milton Fies, engineer for Alabama Power Co., Birmingham.

Refining Division to Meet

CLEVELAND.—Seven technical group sessions have been planned for the fifteenth midyear meeting of the Division of Refining of the American Petroleum Institute, to be held in the Hotel Cleveland here May 1-4.

Thirty-one committee meetings also are scheduled in connection with the 4-day meeting.

A feature of the program will be the presentation of A.P.I. Certificates of Appreciation to Dr. Robert E. Wilson, Standard Oil Co. (Ind.), and Dr. W. B. Hart, Atlantic Refining Co., for outstanding work in the field of refining.

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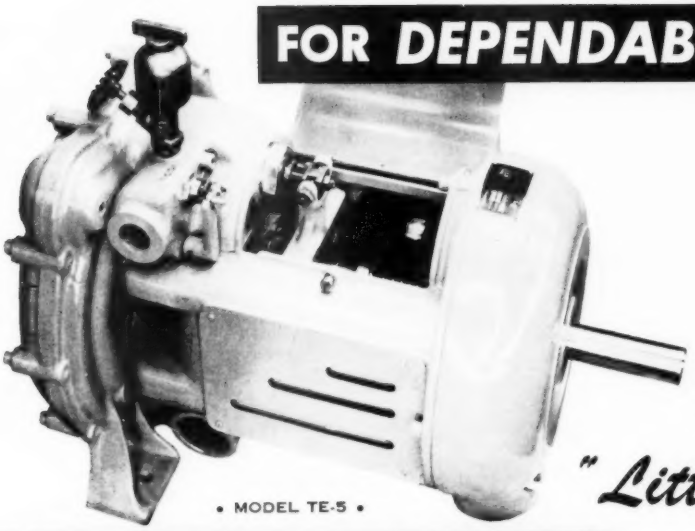

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Tough Wildcat

It took 13 bits to drill the rat hole, and the test was dry, but Sinclair still thinks Ethiopia has possibilities

ONE of the most difficult wildcats in the world has been abandoned as a dry hole at more than 10,000 ft., but Sinclair Petroleum Co. is continuing exploration work in Ethiopia and expects to select a site for a second test well soon.

The well is Sinclair 1 Gumburo, in the Ogaden Desert of southeastern Ethiopia, several hundred miles from anywhere. The region is arid, full of lions, and roamed by nomadic tribes of Solamli, many of whom caused so much trouble that a company of Ethiopian soldiers had to guard the camp continuously.

Moreover, the surface rock is chert so hard that it took 13 bits to drill the rat hole, 24 ft. deep and 12¼ in. in diameter.

Authority for this statement is H. L. Burchardt of Hobbs, N. M., a driller who has just returned to the United States after a year's tour of duty on the Sinclair rig, and who supplied the accompanying pictures.

Burchardt said the drill first went through 1,800 ft. of igneous rock and then several thousand feet of lime and anhydrite streaked with shale.

The 1 Gumburo was nearly 11 months in drilling. Drilling started May 10, 1949, and was suspended April 7, 1950.

Sinclair is continuing geological and geophysical work in the country, and the location for a second test has been postponed until the survey work is further advanced. The 1 Gumburo was the first well ever drilled for oil in the East African kingdom.

Sinclair said the well was carefully cored and tested to obtain important subsurface information. This has caused the company to proceed with an extensive geophysical program which will include magnetometer and will be augmented by additional surface geological study.

The Gumburo test was located about 250 miles southeast of Dire Dawa, between Gabredarre and Waudera, at an elevation of 2,582 ft. There Sinclair has constructed a camp with 26 houses, warehouse, and other facilities. About 60 Americans, including a geophysical crew, are housed there, and many native workers are employed, in addition.

Water was a big problem, and it was necessary to drill several water wells. These also supply water to the nomadic tribesmen.

A heavy rig, good for about 15,000 ft., was moved in for the operation. Most of the equipment came in through the port of Djibouti in French Somaliland, was moved over the narrow-gage railroad to Dire Dawa, and trucked to the location over roads largely built by the company.

Pipe was unloaded from lighters at Mogadiscio in Italian Somaliland and trucked north to the well site. The fuel oil used in drilling was trucked 400 miles from Port Berbera on the Gulf of Aden by local contractors.

Communication with the camp is chiefly by company airplane, and crew members are given frequent leaves in Dire Dawa and Addis Ababa, the capital.

Sinclair Petroleum, a subsidiary of Sinclair Oil Corp., obtained the Ethiopian concession in 1945. Under the original terms, all rights over the 350,000 sq. miles of the country rest with Sinclair for the first 5 years. Half of the area is to be then released. After another 5-year period of ex-

Air view of Sinclair's Gumburo camp in the Ogaden Desert of Ethiopia.

The surface chert was so hard that the mud pit (left) had to be blasted out. On the right is a general view of Sinclair 1 Gumburo during drilling operations.

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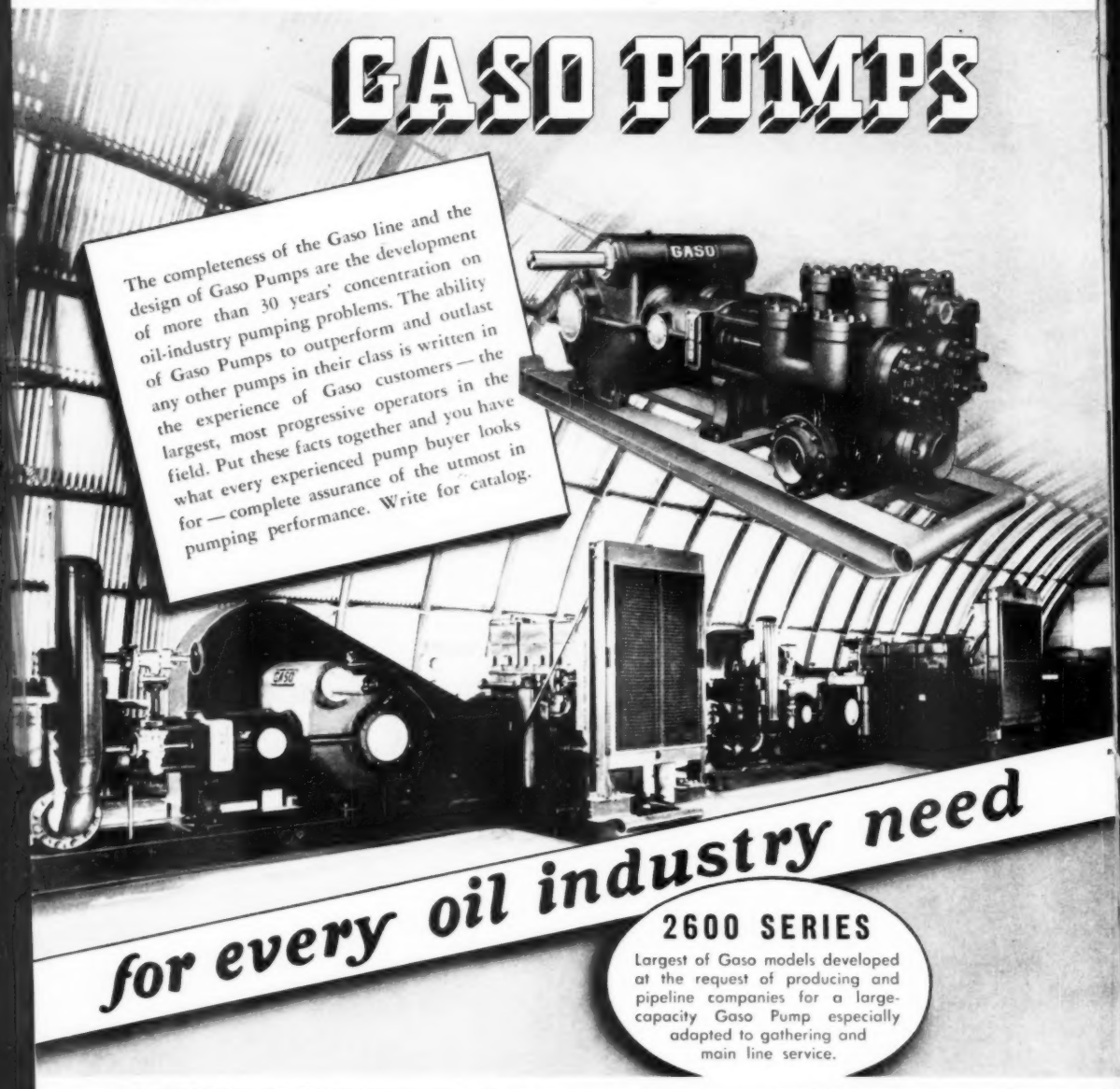

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ploration, 25 per cent more is to be turned back. The remainder continues under concession for 50 years.

About two-thirds of Ethiopia is covered by a lava deposit of varying thickness. The Ogaden is regarded as the most favorable oil prospect from a sedimentary standpoint. A Sinclair official estimated earlier this year that the company's exploration work in the country has cost to date three to four million dollars.

Foreign Production

Drop in Venezuelan output offsets gains in other areas, leaving February output slightly under that of January

Dahl Duff

FOREIGN production of crude oil was down slightly more than 1 per cent in February as a result of the government-requested cutbacks in Venezuela's output.

The month saw a reversal of the trend of a declining production in the United States in contrast to increases in foreign areas. In February United States production gained 38,000 bbl. daily, or about 0.8 per cent, over January.

There were gains in some other foreign areas, notably Iran, but in the foreign total, these were more than offset by the decrease in Venezuela. Production in Venezuela dropped 146,100 bbl. daily, a decline of 10 per cent from the previous month.

This voluntary action was taken by the producing companies in Venezuela on the recommendation of Venezuelan government officials in a move to weaken the campaign in the United States for additional restrictions on foreign oil imports. The United States is the market for nearly half of Venezuela's production.

The cutbacks brought February crude-oil output in the country to 1,318,800 bbl. daily, the lowest since last July. However, weekly figures on production since the end of February show much of this loss has been recovered since. Venezuelan production in the week ended on the date listed was: March 20, 1,385,419 bbl. daily; March 27, 1,398,700 bbl. daily; April 3, 1,402,527 bbl. daily; and April 10, 1,450,800 bbl. daily.

Though off sharply from the previous month, Venezuela's February production of 1,318,800 bbl. daily was approximately 80,000 bbl. daily, or about 6.5 per cent, greater than the daily average in February 1949. United States output, however, is still more than 400,000 bbl. daily, or nearly 8 per cent, below the near record level of a year ago.

Excluding Russia and Eastern Europe, total foreign production dropped about 56,000 bbl. daily, or about 1.5 per cent, from January to February, but the February daily average was nevertheless approximately 345,000 bbl. daily, or slightly more than 10 per cent, above that of the same month of 1949.

Western Hemisphere.—Except for Venezuela, there were no particularly significant changes in other countries of the Western Hemisphere from January to February. Colombia was down slightly, but production in this country is expected to rise above 100,000 bbl. daily after the middle of the year with the completion of additional pump stations on the Andian National pipe line.

Europe.—Western Europe's two principal oil-producing countries made small but significant gains in production. Germany was close to its 1940 all-time high with a February production of 20,400 bbl. daily, or about 80,550 metric tons. Netherlands output was up to about 15,000 bbl. daily as a result of drilling in the Dutch extension of the new German Ruchlertwist field and southwest of Schoonebeek along the German frontier.

Middle East.—Production in the Persian Gulf area showed a gain of about 74,000 bbl. daily, or 5 per cent, from January to February. Iran was at another record-high production level during the month, reflecting British plans to maximumize this production as a part of the dollar-saving program. Iran's February production was nearly 630,000 bbl. daily. This is a gain of more than 19 per cent over February 1949 as contrasted to a gain of not quite 12 per cent for the Middle East as a whole in the same period.

Qatar's production was reported at 20,300 bbl. daily in January and estimated at 25,000 bbl. daily in February. The January figure is considerably below the earlier estimate for

PRODUCTION OF MAJOR FIELDS IN VENEZUELA
(10,000 bbl. daily or more)

	Feb.	Jan.
Cabimas	65,429	77,627
Lagunillas	359,647	368,980
Tia Juana	131,004	165,388
La Paz	149,965	150,524
Bachaquero	88,599	111,223
Mene Grande	48,642	49,141
El Cubo	11,870	12,374
Mara	72,144	97,521
Quiriquire	52,964	41,889
Temblador	9,597	10,111
Oficina	25,697	37,469
Jusepin	26,069	26,863
Mulata	20,079	20,101
Nipa	18,258	37,483
Las Mercedes	16,552	17,250
Taman	11,806	8,966
Santa Barbara	20,871	19,935
Guico	7,120	10,633
Guara	51,844	63,608
Chimire	31,299	36,457

CRUDE-OIL PRODUCTION
(Thousands of barrels daily)

Country—	Feb. 1950	Prev. month	Feb. 1949
Western Hemisphere:			
Argentina	61.0	61.0	63.4
Bolivia	0.5	0.6	1.0
Brazil	0.5	0.6	0.4
Canada	64.1	57.5	50.0
Chile	1.9	1.9	
Colombia	80.4	81.3	78.4
Cuba	0.4	0.6	0.3
Ecuador	7.2	7.2	7.0
Mexico	179.0	174.2	153.0
Peru	41.0	41.0	39.8
Trinidad	56.3	55.7	56.9
Venezuela	1,318.8	1,464.9	1,228.7
Total	1,811.1	1,946.5	1,678.9
Europe and Africa:			
France	1.3	1.3	1.0
French Morocco	0.8	0.8	0.4
Germany	20.4	18.4	14.4
Italy	0.2	0.2	0.2
Netherlands	15.5	11.1	12.2
Egypt	43.8	45.5	38.0
United Kingdom	0.9	0.9	0.9
Total	82.9	78.2	67.1
Middle East:			
Bahrein	30.3	30.6	30.8
Iran	629.8	598.7	527.3
Iraq	114.5	115.5	53.1
Kuwait	268.3	275.0	256.7
Qatar	25.0	20.3	
Turkey	1.4	1.4	
Saudi Arabia	496.4	449.9	532.3
Total	1,565.7	1,491.4	1,400.2
Other Asia:			
British Borneo	75.0	75.0	62.3
Burma	0.5	0.5	0.5
China	1.5	1.5	1.8
India	5.5	5.5	5.3
Indonesia	122.5	122.5	107.3
Japan	5.0	5.0	3.2
New Guinea	4.8	4.8	4.4
Pakistan	2.8	2.5	1.9
Total	217.6	217.3	186.7
Total foreign, less Russia and E. Europe	3,677.3	3,733.4	3,332.9
Estimated Communist-controlled areas:			
Austria	22.0	22.0	17.5
Romania	82.0	82.0	95.0
Yugoslavia	1.2	1.2	1.1
Russia	730.0	730.0	635.0
Other E. Europe	19.1	19.1	14.0
Total	854.3	854.3	762.6
Total foreign	4,531.6	4,587.7	4,095.5
United States	4,960.0	4,922.0	5,376.0
World total	9,491.6	9,509.7	9,471.5

Figures are authoritative for the Middle East, except Turkey, and the more important producing countries of the Western Hemisphere and Europe. In other cases estimates have been made based on the performance of previous months. Figures heretofore shown for the periods covered in the second two columns have been revised where indicated. Data for Russia and Eastern Europe reflect what is believed to be the level of current production.

12-MONTH PRODUCTION TREND

	W. Hemisphere less U. S.	Middle East	Foreign less Russia and E. Europe
March	1,625.9	1,393.4	3,280.2
April	1,678.2	1,485.2	3,488.3
May	1,768.5	1,417.6	3,472.8
June	1,768.8	1,375.7	3,433.3
July	1,800.2	1,338.7	3,428.1
August	1,859.9	1,323.9	3,473.1
September	1,931.8	1,351.5	3,574.9
October	1,921.6	1,428.6	3,645.9
November	1,925.9	1,472.7	3,683.0
December	1,929.3	1,489.6	3,711.0
January	1,946.5	1,491.4	3,733.4
February	1,811.1	1,565.7	3,677.3

this Persian Gulf shiekhdom which only began commercial oil exports at the beginning of the year.

Output in Saudi Arabia increased to nearly 500,000 bbl. daily in February, but the daily average is still considerably below the record 532,000 bbl. daily of a year ago. Currency difficulties have reduced the market for this dollar oil, and there have recently been reports Arabian American Oil Co. has revised downward its earlier 1950 production goal of about 475,000 bbl. daily.

Far East.—No exact, up-to-date information is available on production in Indonesia. Japan's relatively small output has been increased the first 2 months of this year by the new discoveries in Yabase field.

No Drilling Pickup

Number of operating rigs in foreign areas off 18 since last November; marginal exploratory programs being halted

A FURTHER decrease in the total number of rotary rigs operating in foreign areas has been noted in recent months.

The drop in the last few months is slight when compared to the total decrease over the last year. This indicates that most of the reduction in exploratory operations and field drilling was accomplished last year.

Rigs operating in foreign areas totaled 369 as of last month. This figure is 18 below last November and 47 below a year previous. The tabulation excludes Communist-controlled countries of East Europe, Canada, and the occupied areas in Japan and Germany.

A number of marginal exploration programs have been or are in the process of being terminated. Political and legal difficulties in some other countries are reflected in the rig tabulation. Behind the entire situation in general is the more comfortable reserve position of most large companies operating internationally, the currency problems faced by the American companies, and a more slowly expanding world oil demand.

Exploration programs are being ended in Ecuador and Paraguay. Reports also indicate work is coming to an end in Syria, and the single large company in Spain may discontinue participation there. Drilling in Denmark is in abeyance pending clarification of the legal situation, and partly so in Egypt. Civil disturbances have halted drilling in Burma, and several companies ended their work last year in Colombia. In Italy proper, not including Sicily, the major international company has suspended work due to the lack of satisfactory legislation.

Partly balancing this is additional work in a few areas. Shell is preparing to drill in Queensland, Australia, and a rig was moved in on the Trucial Coast recently. Several more rigs are reported operating in Mexico. New equipment also has been reported in New Guinea and the Netherlands.

Despite these fluctuations in drilling activity in other parts of the world, most of the change in the number of rigs running is accounted for by Venezuela. Of the total decrease of 18 from November to March, 14 was reported in Venzuela, and of this, 10 in Western Venezuela.

The accompanying country-by-country tabulation shows rigs operating in Venezuela totaled 78 in March. In addition, in that country, there were 18 rigs on workovers and cleanouts. This gives a total of 96 rigs of all kinds. They were divided among the companies as follows:

Creole 13, Mene Grande 27, Richmond 2, Shell Group 24, Texas 1, Venezuelan Atlantic 7, British Controlled Oilfields 1, Phillips 5, Socony-Vacuum 4, Las Mercedes 7, and Sinclair 5.

FOREIGN ROTARY RIGS

Country—	Mch. 1950	Nov. 1949	Mch. 1949
North America			
Alaska	2	2	2
Cuba		1	1
Mexico	41	37	37
Total	43	40	40
South America			
Argentina	42	42	50
Bolivia	2	2	2
Brazil	5	5	5
Chile	4	4	4
Colombia	13	12	24
Ecuador	13	13	11
Paraguay		1	2
Peru	10	10	21
Trinidad	23	23	22
Venezuela	78	92	133
Eastern	45	49	67
Western	33	43	66
Total	190	204	274
Europe			
England	8	9	9
Denmark			2
Italy	6	6	7
France	12	12	12
Netherlands	5	4	4
Portugal	1		
Spain	1	3	3
Total	33	34	37
Africa			
Algeria	2	2	2
Egypt	6	7	8
Ethiopia	1	1	
French Eq. Africa	1	1	1
Morocco	6	6	6
Tunisia	2	2	2
Total	18	19	19
Middle East			
Bahrein	2	2	2
Iran	9	9	9
Iraq	6	6	6
Kuwait	7	9	9
Qatar	2	2	2
Saudi Arabia	5	5	7
Lebanon	1	1	1
Neutral Zone	1	1	
Syria	1	3	3
Trucial Coast	1		
Turkey	3	3	2
Total	38	41	41
Other Asia			
Australia	1	2	2
China	3	3	3
Burma		1	2
Philippines	2	2	2
East Indies, less New Guinea	24	24	21
New Guinea	6	5	3
India-Pakistan	11	12	12
Total	47	49	45
Grand total	369	387	456

EUROPE

Tax Boost

British double gasoline tax, effect on use questionable

A TAX on motor fuel equal to half the London selling price was provided in the new British budget presented last week by the Labor Government.

The increased tax on gasoline was the principal new levy proposed. Through it and a companion purchase tax on commercial vehicles, the Labor Government expects to gain enough revenue to offset the partial relief given in the lower brackets of the income tax. The budget is expected to be approved in the House of Commons.

The greatly increased tax was a stiff jolt for the British petroleum industry as well as for consumers. Its effect on consumption of the product in the United Kingdom is problematical. It was announced that basic ration for motorists will be doubled to 180 miles, but the new tax will discourage vehicle use.

A Road Transport Association in London declared the government was seeking to divert freight to the nationalized railroads which are operating at a deficit.

The new tax will be 1 shilling and 6 pence, double the old rate of 9 pence. The London price will thus rise from 2 shillings 3 pence to 3 shillings. These figures are for Imperial gallons (35 per barrel) for 70-72 octane, the only grade sold for private motorists.

The new British gasoline price is equivalent to 35 cents per U. S. gallon with the tax half of this figure or 17½ cents. However, the comparison is misleading since the purchasing power of the pound in the United Kingdom is some greater than the controlled rate of $2.80 would indicate.

The 1 shilling 6 pence tax is the highest on gasoline in British history.

In that country motor-fuel prices have fluctuated considerably in the past due to changes in tanker rates, world markets, and price wars. However, the new tax in effect will take away from the motorist the benefit of reductions which have been made in price of the product itself.

The British gasoline tax was first imposed in 1916 at 6 pence when the total price was 2 shillings and 10 pence. After a period of 7 years in the 20's when there was no tax, the levy went to 8 pence in 1931 and to 9 pence in 1938. The latter rate prevailed during the war and up to the present.

Refinery to Go on Stream

The Augusta (Sicily), Italy refinery—Raffinerie Siciliane Olii Minerali (RASIOM)—will go on stream next month, according to present plans.

The first unit to be operated will be the topping plant with an initial capacity of about 12,000 bbl. daily. By fall it is expected the 8,000 bbl. thermal cracking unit will be on stream. At that time the gas-recovery plant will be completed. This will be the source of a supply of liquefied petroleum gases which will be distributed in Italy by the company.

This refinery was formerly owned by Danciger Oil & Refining Co. and was operated for several years at Longview, Tex. Erection of the plant at the new location started last August.

The company plans to build a catalytic cracking unit later. Consideration is also being given to the installation of facilities for the manufacture of lubricating oils. The refinery will operate initially with crude oil from the Middle East fields supplied by both American and British interests.

Crude Line for Scotland?

Construction of a crude-oil pipe line across Scotland from Loch Long to the Grangemouth refinery of the Anglo-Iranian Oil Co., Ltd., organization is under consideration.

The project would involve construction of a tanker station and pumping plant at the starting point. The line would have a capacity of 2,000,000 tons a year (about 40,000 bbl. daily) and would cost an estimated £2,500,000 ($7,000,000). The Grangemouth refinery is owned by Scottish Oils, Ltd. (controlled by Anglo-Iranian) and is being expanded to 1,800,000 tons a year capacity.

New TEL Facilities

Associated Ethyl Co., Ltd., manufacturers of Ethyl antiknock compounds, have announced plans to expand production facilities in Britain.

The program comprises plans for the production of TEL, sodium metal, ethyl chloride, ethylene dichloride, and extraction of bromine from sea water. The new facilities are expected to be in operation early in 1953.

CANADA

Work at Winnipeg Begins

Construction work was officially commenced last week on the new 10,000-bbl. daily refinery of Imperial Oil, Ltd., at Winnipeg, Manitoba.

D. L. Campbell, Manitoba premier, turned the first sod on the 400-acre site in ceremonies marking the commencement of construction. The plant, to cost about $10,000,000, is due for completion in May 1951.

Crude will be supplied from Alberta fields through the line now under construction from Edmonton to Lake Superior. A take-off point for the refinery will be at Gretna, Manitoba.

The new refinery will be the first for Winnipeg and will more than double the existing refining capacity in the province.

LATIN AMERICA

Public-Relations Proposal

Edward Ospina-Racines, Colombian engineer, has followed up his proposal for a Latin American oil public-relations program by submitting a detailed outline to interested oil companies.

His plan is for a small-scale version of the American Petroleum Institute public-relations program to be carried out in Venezuela, Colombia, Ecuador, and Peru *(The Oil and Gas Journal, March 2, page 35)*.

In his memorandum, cost of the program is placed at $60,000 for the first year, with around $5,000 each from a group of sustaining companies. Booklets, lectures, motion-picture exhibitions, and press material would be used to create a more favorable atmosphere for the private oil industry in Latin America.

Deep Test Finds Oil

Creole Petroleum Corp.'s Alturitas wildcat in Western Venezuela has recovered oil on a drill-stem test below 15,777 ft.

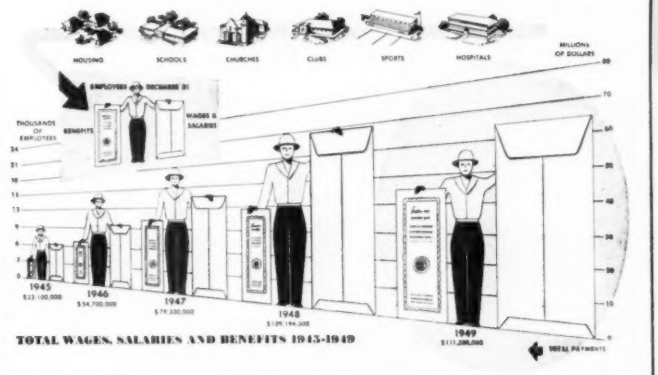
The well is the deepest ever drilled outside the United States, and if production is obtained, will be the world's deepest producing well. On a recent test, 59 stands of 31.6°-gravity oil and mud were recovered in 4 hours. Some difficulty with the hole was experienced, and a milling operation has been undertaken.

Refinery on Stream

The 30,000-bbl. refinery of Gulf Refining Co. at Puerto La Cruz, Venezuela, was placed on stream April 25.

The plant is owned two-thirds by Gulf Oil Corp. and one-third by The Texas Co. through their operating subsidiaries in Venezuela.

Principal products of the new refinery will be gasoline, furnace oil, diesel fuel, and heavy fuel oil.



***WHERE IT GOES.**—This illustration, from the annual report of Creole Petroleum Corp., shows the heavy indirect labor costs required in the oil industry, particularly in foreign areas. Creole, the world's largest producing company and the major operator in Venezuela, last year spent $46,765,000 for various employe benefits such as medical care, accident, sickness and death benefits, retirement, commissaries, housing, schools and training facilities, sports, and other social benefits. This sum is about 72 per cent as large as the company's direct payroll charges of $65,753,000. Included in the 1949 benefit costs were severance indemnities of $6,454,154. Creole during the year reduced number of employes by 17 per cent to 17,330.*

PERSONALS

Veteran Geologist

Cartwright has been with Union Oil since 1939

WITH more than 20 years' experience in the field of geology, Lon D. Cartwright, Jr., chief geologist for Union Oil Co. of California, has had a well-rounded background for filling his present position. From his headquarters in Los Angeles, he is responsible for correlation of all geological, geophysical, and exploration activities of the firm's various divisions, acting through the division managers.

Cartwright was born at Terrell, Tex. Reared in San Antonio and Beaumont, he attended New Mexico Military Institute. In 1924 he graduated from the University of Texas with a B.A. degree in geology, and attended Stanford University in 1925 and 1926, receiving his A.M. degree in geology in 1927.

Professional work began for Cartwright in 1924 in the West Texas Permian basin with Ricker & Dodson, independent operators. Subsequent to graduate studies at Stanford, he worked in the Permian basin for the California Co., and later for Superior Oil Co. of California. From 1931 to 1934, he worked as independent geologist in both East and South Texas. He joined Skelly Oil Co. at Houston in 1934 and served as division geologist, covering the Gulf Coast of Texas and Louisiana. From 1939 until his recent appointment he was chief geologist, Gulf Coast area for Union Oil Co.

Cartwright is a member of Kappa Alpha fraternity, Sigma Gamma Epsilon geological fraternity, Geological and Mining Society, American Institute of Mining and Metallurgical Engineers, American Association of Petroleum Geologists, Sigma Xi, scientific honorary fraternity, and Fellow of Geological Society of America.

H. H. Howell, former Alice, Tex., independent oil man, has opened offices in San Antonio. **Milton H. Bailey,** formerly landman with Mestena Oil & Gas Co., San Antonio, has joined Howell.

Travis Cravens, district landman for Continental Oil Co., San Antonio, has resigned effective May 1 to join **Marvin Leonard,** Fort Worth independent.

Daniel D. Adams has been appointed zone agent for Gulf Oil Corp. in Oklahoma City to succeed the late M. V. Rushmore. For the past 10 years Adams has been assistant to Rushmore. **C. B. Dugger** will assume some of the duties formerly handled by Adams.

A. E. Malverson, director of Imperial Oil, Ltd., is to retire at the end of April. Formerly general manager of marketing throughout Canada for the company, Malverson in 1945 became contact director for a number of corporate departments at the Toronto executive offices.

M. Kamen-Kaye has resigned as chief geologist of Caracas Petroleum Co. in Venezuela and will establish offices as consulting geologist in New York.

Norman Hardy, president of Richmond Exploration Co., has moved his headquarters from Caracas to Maracaibo in Venezuela. **L. W. Henry** and **C. R. Cabrera** will continue to retain offices for Richmond in Caracas.

Gen. Levin H. Campbell, Jr., executive vice president of International Harvester Co., has been elected to the board of directors of Universal Oil Products Co., Chicago.

James E. Pew, manager of Sun Oil Co.'s natural-gas and natural-gasoline division of the production department, has been elected to the board of directors. He is president of Natural Gasoline Association of America and during World War II was director of the natural-gas and natural-gasoline division of Petroleum Administration for War.

M. T. Steven has been appointed construction manager of British American Oil Co.'s new refinery at Edmonton, Alta., and **N. J. Wills** has been appointed plant-construction superintendent.

James Q. Snell, chief scout in Tide Water Associated Oil Co.'s Houston office, has been transferred to Corpus Christi as district landman. Other changes include: **Jefferson B. Goldman,** assistant geologist at Jackson, Miss., transferred in a similar capacity to Houston; **William S. Shipman,** scout at Jackson, transferred to Houston as chief scout; and **Moody Covey,** named junior engineer at the company's Drumright, Okla., refinery.

Keith Lewis, superintendent of Imperial Oil, Ltd.'s, Montreal East refinery since 1948, has been appointed superintendent of the company's new Winnipeg refinery. Lewis joined Imperial in 1933 at its Halifax refinery. In 1942 he joined St. Clair Processing Corp. as one of the specialists needed for Canadian war-time production of synthetic rubber, and later became assistant manager. He returned to Imperial shortly after St. Clair was merged with Polymer Corp.

William E. Morris, formerly research engineer for Standard Oil Development Co., has joined the petroleum laboratories of E. I. du Pont de Nemours & Co., Inc., at Deepwater, N. J., where he will study performance of leaded gasolines in automobile engines.

G. G. Galligan, district head of the land department for Stanolind Oil & Gas Co. at Wichita Falls, Tex., will be transferred May 1 to the company's Northwest New Mexico and Arizona district with headquarters in Albuquerque. He will be succeeded at Wichita Falls by **Tom Yancey,** Abilene, Tex.

John E. Selden, Bradford, Pa., has been elected president of South West Pennsylvania Pipe Lines, succeeding **R. L. Cronise,** who retired. **C. E. Loane** and **C. R. Guignon,** both of Washington, Pa., were named directors.

Alec M. Crowell, Frank P. Donohue, and **Joe B. Zick** have formed a service organization for the owner, buyer, and seller of natural gas which is known as Natural Gas Associated Consultants, with offices in New Orleans.

Thomas R. Shugart, formerly vice president of Geotechnical Service Corp., has opened an office in Dallas as a geophysical consultant specializing in seismic interpretations.

Reginald N. Blaize, who has been manager of refineries for Eastern States Petroleum Co., Inc., Houston, since 1948, has been elected executive vice president of the company. He joined the firm as inspection and process engineer in 1940, and in 1943 was made assistant plant superintendent and later chief engineer. He received his B.S. degree from Louisiana State University in 1934.

William M. Brodrick has been appointed Kansas division exploration manager for Anderson-Prichard Oil Corp., succeeding **Millard W. Smith,** who resigned to join Anschutz Drilling Co. Brodrick is a graduate of Montana School of Mines and has been with the company since 1947.

E. W. Robbins, geologist for Sinclair Oil & Gas Co. at Casper, Wyo., has been transferred in a similar capacity to Billings, Mont.

Ralph O. Rhodes, chief staff geologist for Gulf Oil Corp., Pittsburgh, and **D. H. Hedberg,** chief geologist in Gulf's New York foreign-production office, arrived in Caracas, Venezuela, early in April for a stay of several weeks.

Bernard W. Allen, petroleum engineer for Ohio Oil Co., has been transferred from Lander to Thermopolis, Wyo., in the same capacity.

Ray Sing, superintendent for Gabe McCall Drilling Co. at Lander, Wyo., has been transferred to the Casper, Wyo., area.

R. E. Ashley, geologist for Phillips Petroleum Co., has resigned to join the U. S. Geological Survey's Alaskan and foreign geological branch. He will be assigned to Nyasaland, Southeast Africa.

R. C. Gangwer, formerly with Gilliam Drilling Co., Evansville, Ind., is now operating as an independent, with headquarters at Newburg, Ind.

Harold R. Stiles, district landman for Midstates Oil Corp., Tulsa, has resigned to enter the oil-field trucking business.

Harry Hottinger is president of Vistario Corp., newly formed company which will engage in operations in Rio Vista gas field of California, near San Francisco. Others associated with Hottinger are **William Rosenwald, Peter Lavan, Samuel Ballen, O. M. Muhler, W. J. Straus,** and **Frank W. Williams.**

A. L. Robinson has been named crude-unit foreman at Carter Oil Co.'s Billings, Mont., refinery. He formerly was manufacturing-department public-relations manager.

James Dean, formerly with Jones & Simpson Drilling Co., is now doing consulting geological work, with offices in Mattoon, Ill.

George T. Becker, formerly located in Colombia with the Gulf organization, has been transferred to Mene Grande Oil Co. in Venezuela, attached to the reservoir-engineering division of the production department in San Tome.

Jack Hough, Rocky Mountain area landman for Stanolind Oil & Gas Co., has been transferred to Jackson, Miss., in that capacity.

G. F. McMillan, Gulf Oil Corp., has been elected president of the Denver Petroleum Club, succeeding **James C. Johnston,** Continental Oil Co. Other officers include: **C. L. Bainter,** National Supply Co., and **H. Leslie Parker,** independent operator, vice presidents; and **Oscar Wood,** secretary, Colorado Petroleum Industries Committee, secretary-treasurer. New members of the board of directors include: **Samuel Butler, Jr.,** Sharples Oil Corp.; **C. H. Dodson,** The Texas Co.; **C. L. Picket,** the California Co.; **A. K. Smith,** Standard Oil Co. (Ind.), and Bainter.

James H. Alkire has joined Magnolia Petroleum Co. at Lovington, N. M., as a junior geophysical engineer. He is a recent graduate of Colorado School of Mines.

Dan S. Johnston, general drilling superintendent for Signal Oil & Gas Co., has been elected president of the Rolling Hills Toastmasters Club, Long Beach, Calif.

W. E. Reed, superintendent for Stovall Drilling Co., Inc., Monroe, La., has moved to Salanta, Kans., as Kansas superintendent.

V. P. Baker, president of the newly formed Balboa Oil Co., has established offices in Midland, Tex. Others connected with the petroleum development and exploration company include: **Samuel H. Marshall,** geologist, Roswell, N. M., vice president; and **R. E. Williams,** Midland independent oil operator, secretary-treasurer. Members of the board of directors include: **Robert M. Turpin,** Midland; **R. N. Hunt,** Salt Lake City, and the principal officers of the company.

Robert Posey, Magnolia Petroleum Co., Drumright, Okla., was recently named chairman of the new Drumright chapter, American Petroleum Institute.

Harry T. Bennett, technical director of Mid-Continent Petroleum Corp., Tulsa, has been named to receive the John Scott Award at Cleveland May 3 at the American Petroleum Institute's Division of Refining meeting. Bennett will receive the award for

FOREIGN GUESTS.—Visitors from abroad attending the April meeting of the Los Angeles chapter of Nomads included, front row, left to right, E. N. Mitchell, Philippine Oil Development Co.; E. W. Hannay, Arabian American Oil Co.; R. H. Deem, Shell Oil Co. of Colombia; V. E. Freel, Drilling & Exploration Co., Brazil. Back row: F. Vermersch, S.C.P., French Morocco; Gerard Landroit, S. N. Repal, Algeria; and H. G. Karnes and B. L. Coker, International Petroleum Co., Ltd., Syria.

PERSONALS

his achievements in stabilizing cracked gasoline, making possible a low-cost, high-octane motor fuel. A graduate of University of Delaware, Bennett has been with Mid-Continent since 1917, when it was Cosden & Co.

Virgil Anderson, manager of Drumright Gas Service, Drumright, Okla., has formed Production, Inc., with **Patrick Cawley, Gordon R. Rockett,** and **Dr. Russell Godlet,** and will be active in the Drumright area.

D. S. Skinner, formerly superintendent of the Rocky Mountain district, Continental Oil Co.'s pipe-line department, Lance Creek, Wyo., has been named superintendent of the Oklahoma-Kansas district, with headquarters in Ponca City, Okla. **R. R. Martin,** district clerk at Lance Creek for the past 10 years, has been named superintendent of the Rocky Mountain district, succeeding Skinner. Skinner joined Continental in 1931, and Martin joined the company in 1937.

Curtis G. Condra, Fort Worth, has been named chairman of an advisory committee to the Interstate Oil Compact Commission by Texas Mid-Continent Oil and Gas Association. Other members of the committee include: **John F. Lynch,** Corpus Christi; **Raymond L. Dillard,** Mexia; **H. E. Chiles, Jr.,** Midland; and **Watson W. Wise,** Tyler.

Douglas F. Edman, district landman for British American Oil Producing Co., has been transferred to Midland Tex., where the company has established district offices.

James M. C. Ritchie, geological scout for Plymouth Oil Co. at Corpus Christi, has been transferred to the company's Midland, Tex., division offices, succeeding **Jack Harvey,** who has been transferred to Abilene.

SHIFTS

W. J. Bierrens de Haan, engineer, Shell Oil Co., Netherlands to Houston, Tex.; **H. F. Staggs,** superintendent, Penrod Drilling Co., Midland to Seminole, Tex.; **Burrell G. Taylor,** engineer, Kerr-McGee Oil Industries, Inc., Orange to Lubbock, Tex.; **H. J. Basham,** superintendent, Texas Pipe Line Co., Wichita Falls to Pampa, Tex.; **C. E. Siberts,** geologist, Kingwood Oil Co., Evansville, Ind., to Mount Vernon, Ill.; **George E. Frey,** engineer, Spencer Chemical Co., Parsons, Kans., to Joplin, Mo.

Royston W. Moore, engineer, Continental Oil Co., Ville Platte, La., to Beeville, Tex.; **J. R. Ramirez,** engineer, Standard Oil Co. (Ind.), Calumet City, Ill., to Santa Ana, Calif.; **Marlin R. Taylor,** engineer, Gulf Oil Corp., Centralia, Ill., to Coffeyville, Kans.; **Deane E. Kilbourne,** geologist, The Texas Co., Craig, Colo., to Casper, Wyo.; **G. D. Guttersen,** engineer, The Texas Co., St. Paul, Minn., to Milwaukee, Wis.; **Ray Drewell,** H. C. Price Co., Greenlawn Trailer Court, Collinsville to Zanesville, Ohio; **W. C. Posey,** superintendent, Zephyr Corp., Fairview to Pauls Valley, Okla.; **R. M. Brackbill,** engineer, Shell Oil Co., Oklahoma City to Calgary, Alta., Canada.

W. T. Black, superintendent, Kerr-McGee Oil Industries, Inc., Freeport, Tex., to Ruston, La.; **W. C. Broussard,** engineer, Fish Constructors, Inc., Houston, to Opelousas, La.; **W. W. Watkins,** Shell Oil Co., Sheridan to Yoakum, Tex.; **Joseph R. Ault,** engineer, Carter Oil Co., Canton, Miss., to Tallulah, La.; **Robert V. McCann,** superintendent, Camay Drilling Co., Fillmore to Compton, Calif.; **Louis S. Hochman,** geologist, Continental Oil Co., Palo Alto, Calif., to Ely, Nev.; **Richard B. Krause,** geologist, Ohio Oil Co., Van Nuys, Calif., to Minneapolis; **John W. Harding,** geologist, Union Oil Co. of California, Bakersfield to Santa Paula, Calif.; **W. E. Lake,** superintendent, Bechtel Corp., Bakersfield to Richmond, Calif.; **Norman Edge,** geologist, Continental Oil Co., Kenedy to Gonzales, Tex.; **A. G. Morton,** National Geophysical Co., Inc., Throckmorton, Tex., to Harlowton, Mont.

Asas D. McRae, geologist, Magnolia Petroleum Co., Lake Charles to Morgan City, La.; **R. A. Malott,** Shell Oil Co., Ojai to Ventura, Calif.; **Albert L. Carpenter,** engineer, Humble Oil & Refining Co., Bay City to Thompsons, Tex.; **W. P. Lawrence,** Amerada Petroleum Corp., Big Spring to Childress, Tex.; **Robert Davenport,** engineer, Amerada Petroleum Corp., Logansport, La., to Sulphur Springs, Tex.; **C. C. Mason,** superintendent, Humble Oil & Refining Co., Baton Rouge, La., to Midland, Tex.; **Fred E. Wood,** engineer, Oak Park, Ill., Evansville, Ind.; **Edd Riddle, Jr.,** geologist, Texas Pacific Coal & Oil Co., Sheridan, Wyo., to Davis, Okla.; **H. R. McFarland,** engineer, Beacon Petroleum Corp., Tulsa, to Houston; **Joe T. Morriss,** superintendent, Tennessee Gas Transmission Co., New Castle, Pa., to Zanesville, Ohio.

W. E. Haberer, engineer, Humble Oil & Refining Co., Corpus Christi to Kingsville, Tex.; **William W. Gardner,** engineer, Henderson Engineering Co., San Antonio to Carthage, Tex.; **Neal Martin,** superintendent, W. H. Black Drilling Co., Seminole, Tex., to Farmington, N. M.; **D. R. Brinton,** geologist, Continental Pipe Line Co., Wichita Falls to Throckmorton, Tex.

DEATHS

Edward P. Taft, Jr., 34, gas engineer for Stone & Webster Service Corp., New York, died April 18.

Edward B. Heyden, 51, vice president of Graver Tank & Manufacturing Co., died April 19 in New York.

Jahn W. Ray, 50, field engineer for Magnolia Pipe Line Co. for the past 25 years, died near Kilgore, Tex., April 20.

C. S. Whitman, 56, manager of R. J. Oil & Refining Co., Inc.'s refinery at Princeton, Ind., died April 14.

L. E. Garfield, 48, chief engineer for Hughes Tool Co., Houston, died in Rochester, Minn., recently. He joined Hughes in 1927 and was made chief engineer in 1942.

Seymour J. Dean, 62, chief engineer for Phillips Petroleum Co. at Seminole, Okla., died in Oklahoma City April 20.

A. C. Frank Gillett, 62, oil-well-supply firm owner, died April 19. He had operated the Gillett Supply Co., Tulsa, for 15 years.

John L. Huder, 65, head auditor for Hewitt & Dougherty Oil Co., Beeville, Tex., died April 18. He formerly was associated with United Gas Corp., Houston.

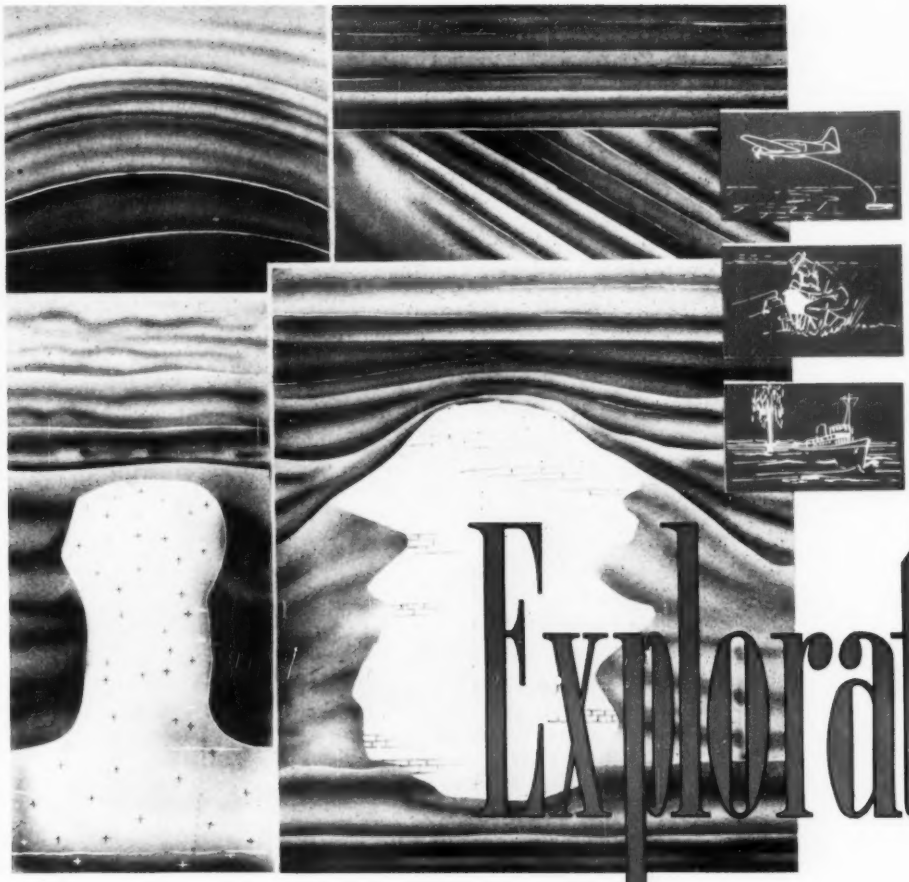
B. F. Carroll, 59, oil operator, died in Tyler, Tex., April 21.

Charles C. Cartwright, 72, former vice president of the Texas division, National Supply Co., died April 22 at Fort Worth.

Roger J. Fleckenstein, 59, production manager of Texas-Pacific Coal & Oil Co., died April 20 in Fort Worth.

Harry Kirschner, 75, independent oil operator of Muskogee, Okla., died April 18.

John B. Bass, chief accountant at the Ponca City, Okla., refinery of Continental Oil Co., died April 19.



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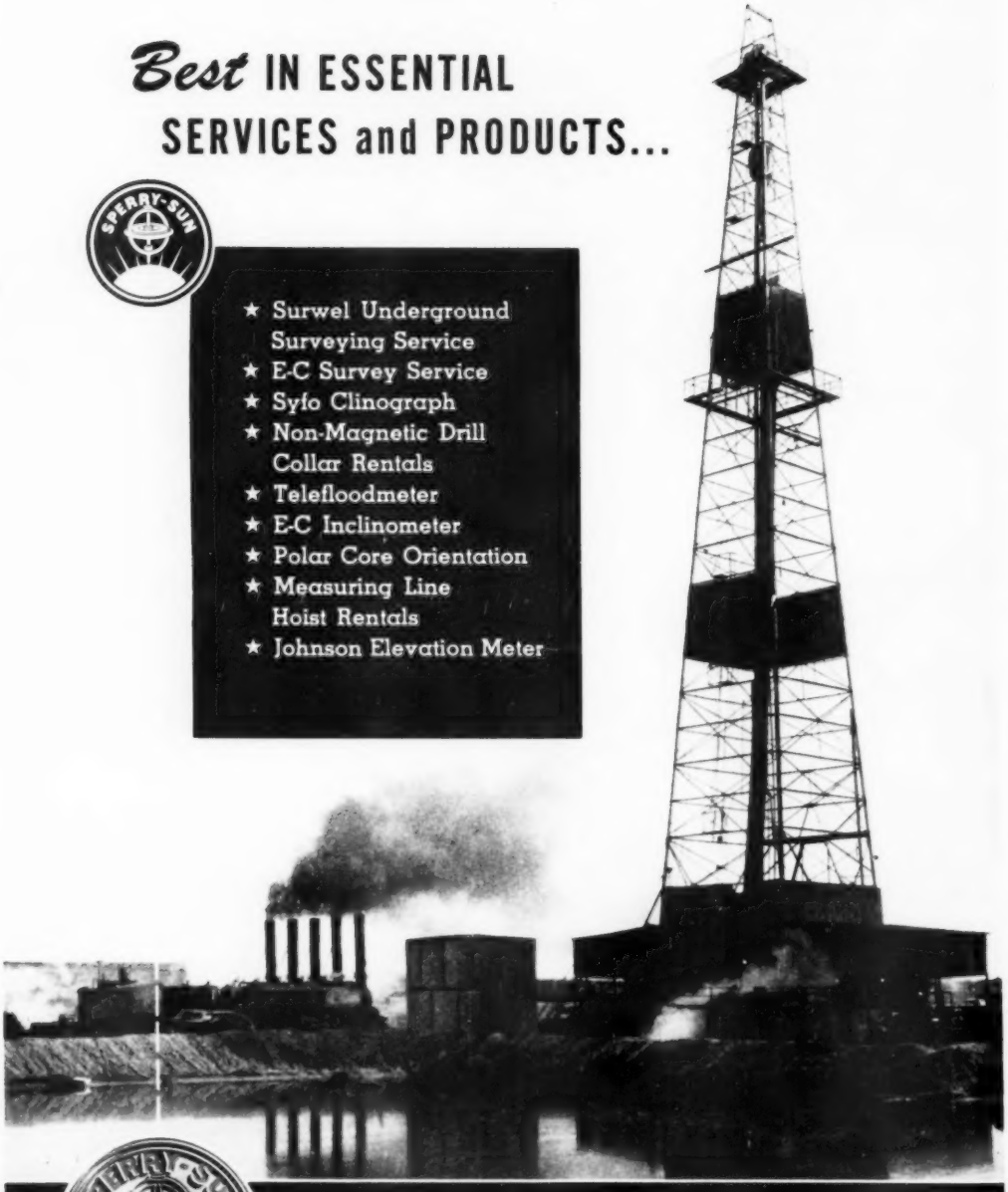

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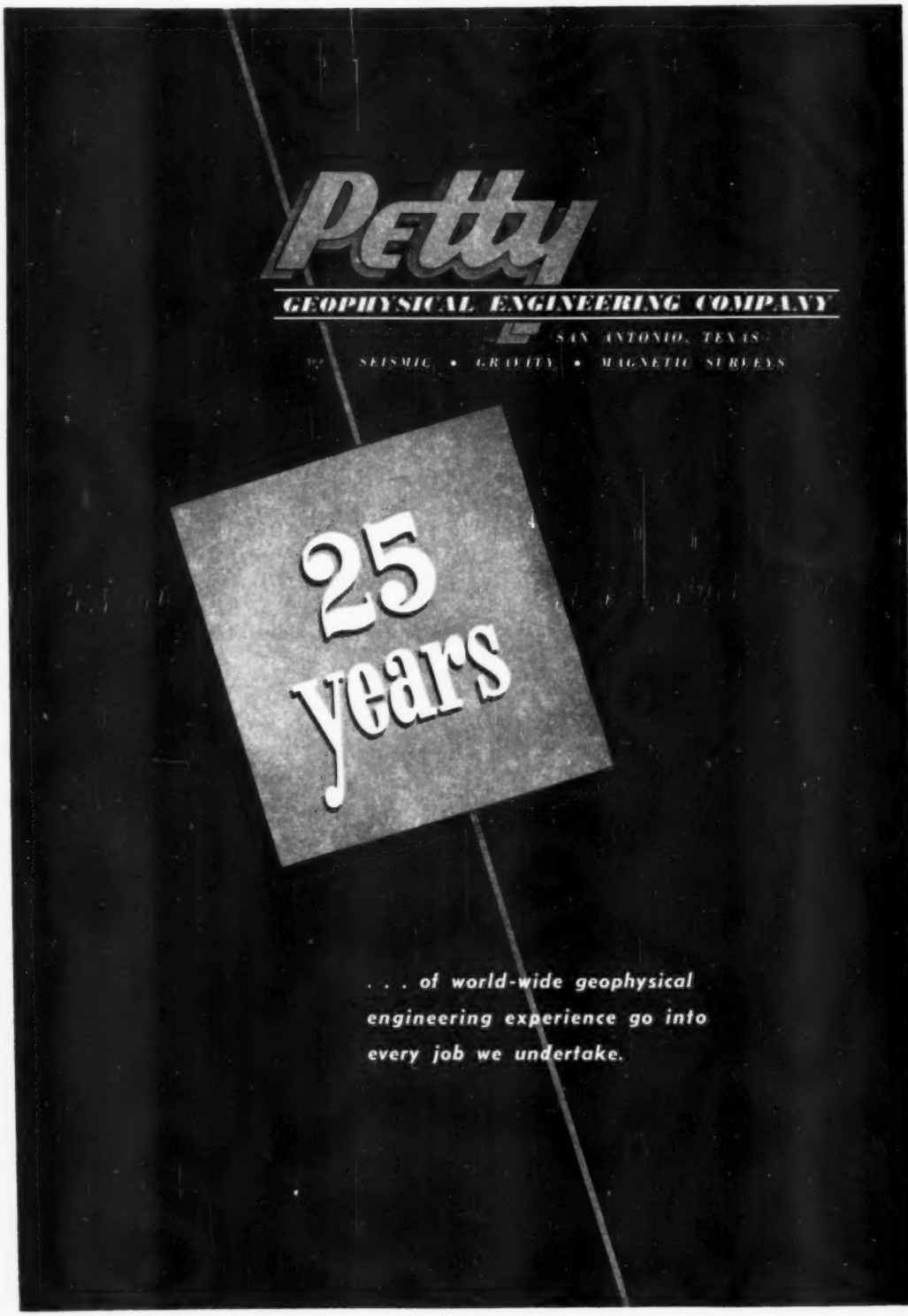
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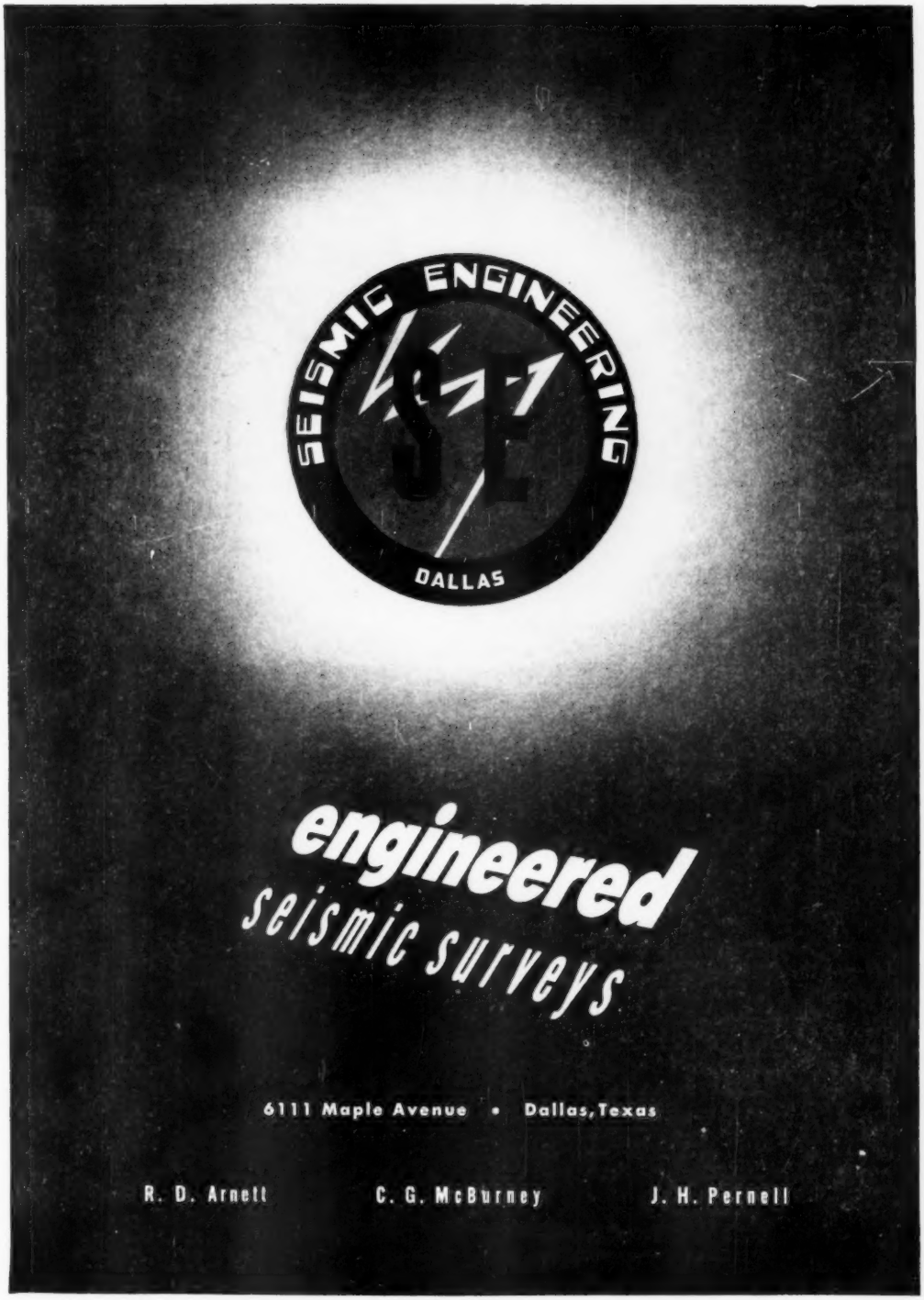
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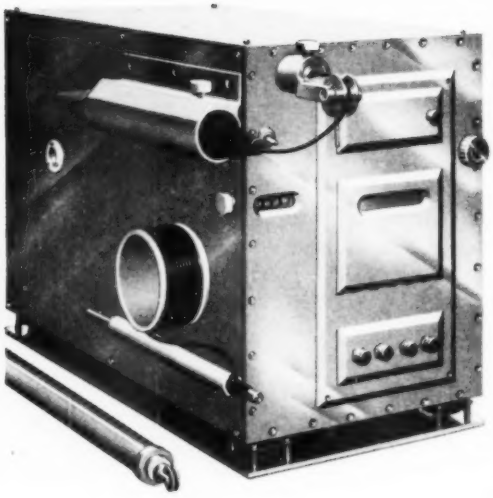

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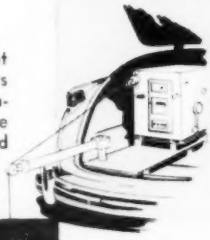

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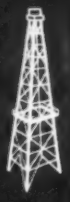

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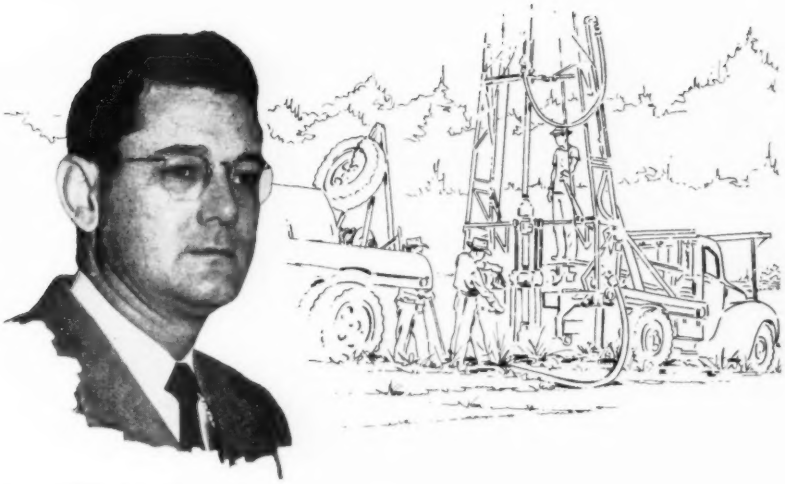

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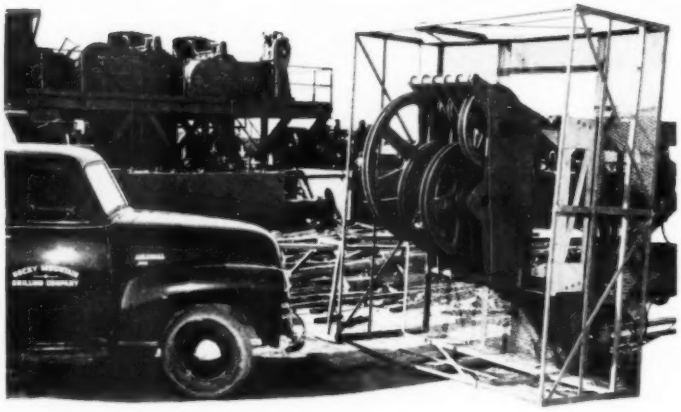

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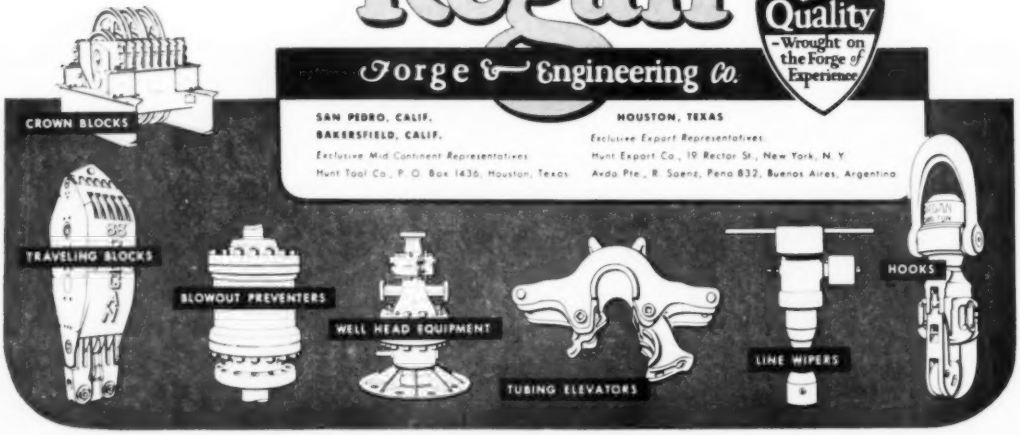

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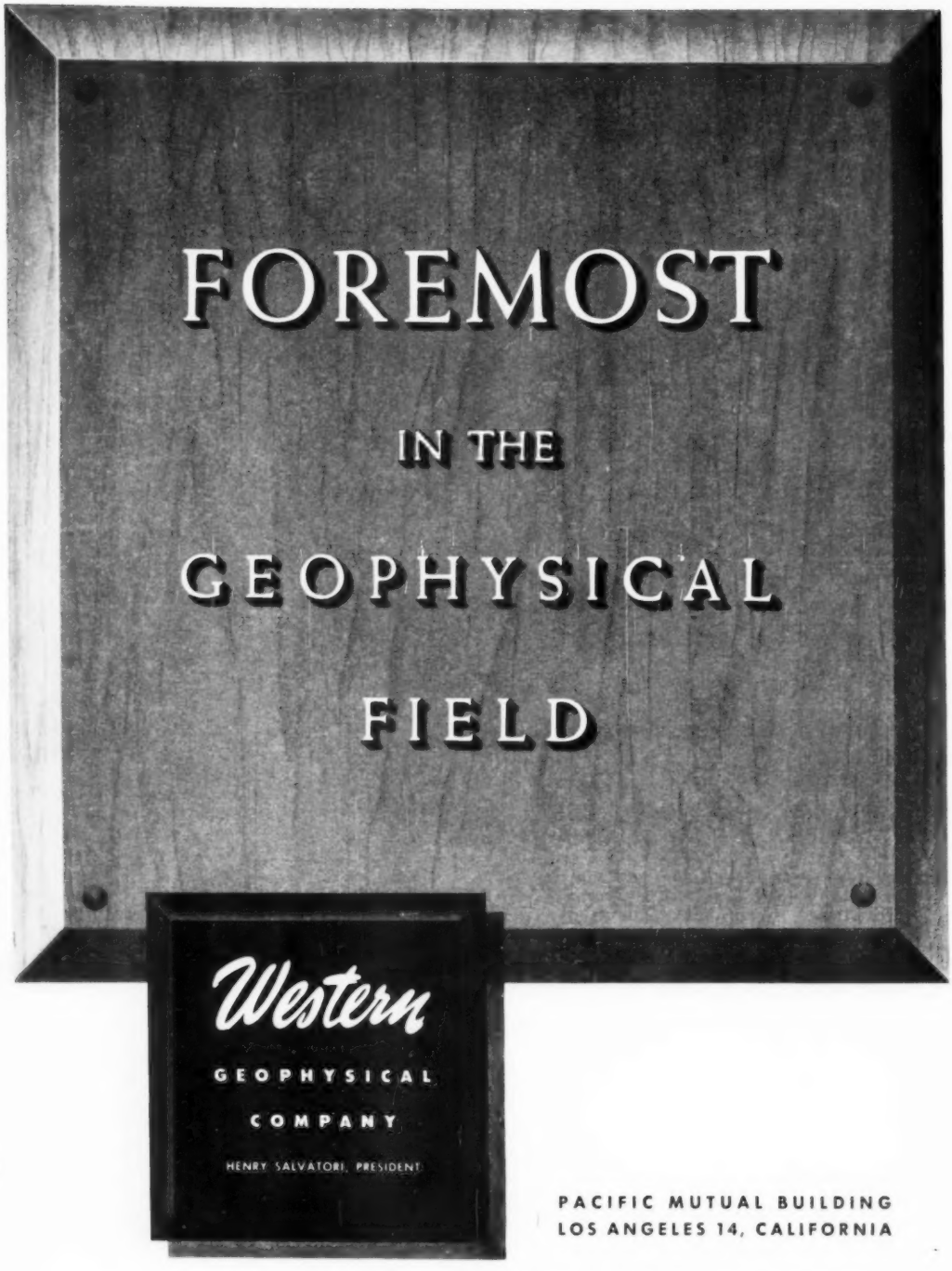

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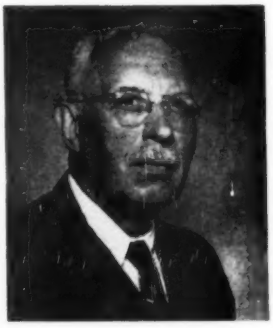
the world in 1949

Geophysical Activity

by E. A. Eckhardt*



E. A. ECKHARDT

THE trend of geophysical activity during 1949 was away from the United States; whereas, seismograph activity in the United States was down 1.43 per cent from the preceding year, that elsewhere was up 28.85 per cent. Gravity operations in the United States in 1949 was down 31.29 per cent as compared to 1948. Elsewhere the decrease was 14.17 per cent. This report is designed to give a composite picture of the geophysical operations of last year with regard to their magnitude and geographic distribution.

The strong downward trend in evidence for the major part of last year may have obscured the fact that, nevertheless, on a world-wide basis, the geophysical activity of the petroleum industry in 1949 was level with, if not slightly above, that of the preceding year. World-wide seismograph activity was up about 4.76 per cent, whereas, the comparable gravity activity was down a more substantial 24.24 per cent. However, the added cost of the additional seismograph work probably just about offset the amounts saved by the reduction in gravity operations so that the global bill of the industry for its geophysical operations in all probability was substantially the same in 1949 as it was in 1948.

The world distribution of seismograph operations in 1949 is depicted in Fig. 1. The United States' share of the total is less than that of the previous year by almost five percentage points. Canada's jump from 5.76 to 9.54 per cent of the world total is, perhaps, the most striking development of the year. Canada gained a major part of what the United States

*Gulf Research & Development Co., Pittsburgh. This article is a report of the committee on geophysical activity of the Society of Exploration Geophysicists. The members of this committee are A. A. Brant, Herbert Hoover, Jr., D. C. Skeels, and E. A. Eckhardt, chairman.

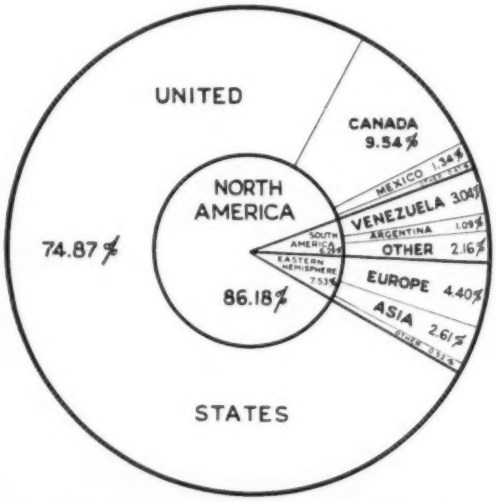


Fig. 1—World distribution of seismograph in 1949.

Fig. 2—World distribution of gravimeter activity.

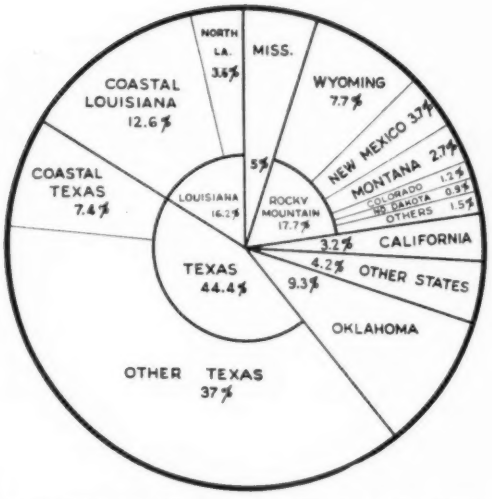


Fig. 3—Distribution of 1949 Seismograph operations in United States.

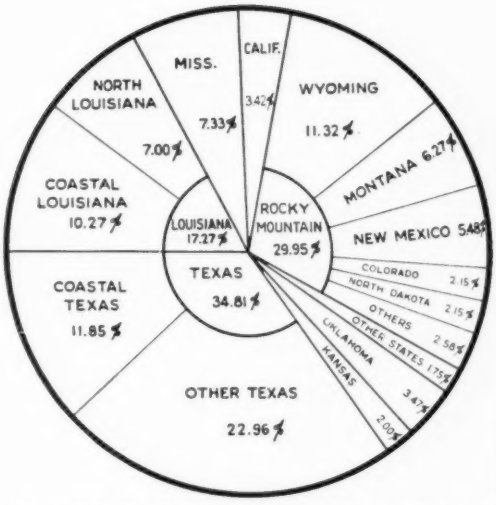


Fig. 4—Distribution of 1949 gravimeter operations in United States.

lost. However, the gain in the Eastern Hemisphere from 4.45 per cent in 1948 to 7.53 per cent in 1949 is almost as impressive, and the gain in the share of Europe (1.78 to 4.40 per cent) indicates the most rapid expansion found anywhere.

As shown in Fig. 2, gravity operations likewise underwent material changes in their distribution during 1949. The United States' share of the world total dropped from 67.9 per cent in 1948 to 53.4 per cent in 1949. For the same periods, Canada's share increased spectacularly from 5.9 to 12.1 per cent, scoring more than a twofold increase. South America just about maintained its proportion, but the Eastern Hemisphere operations rose robustly from 11.5 to 19.8 per cent.

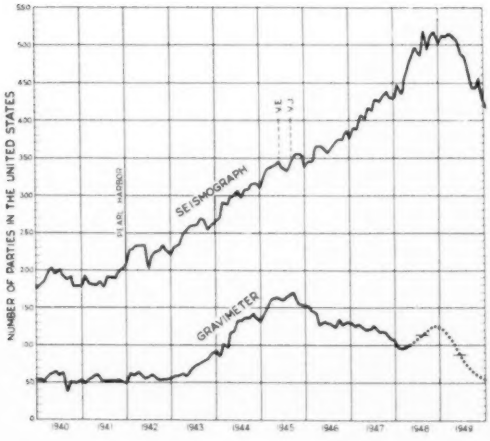
The distribution of seismograph activity in the United States in 1949, shown in Fig. 3, was very much like that of the preceding year. It is worthy of note, however, that, although the total of such work last year was slightly reduced, the State of Texas achieved a minute increase and, as for some years back, increased its share of the total. The Rocky Mountain States also improved their relative position. In Louisiana the reduction came almost entirely from a sharp progressive reduction of offshore operations during the year.

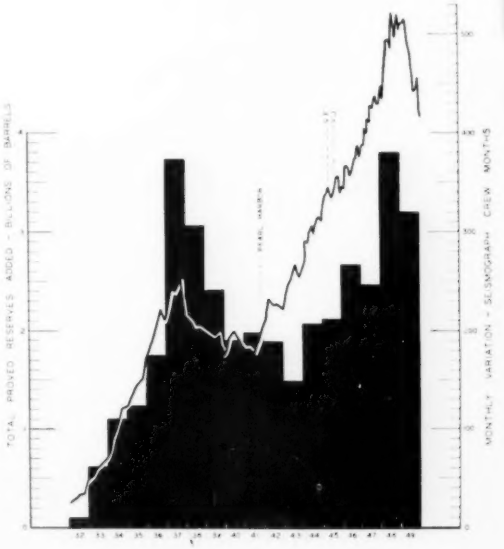
The relative distribution of gravity work done in the United States in 1949 is shown in Fig. 4. In 1948, Texas and Louisiana accounted for 62.7 per cent of all gravity work in the United States. In 1949, the share of these states was down sharply to 52.08 per cent. These states therefore appear to

(Continued on page 124)

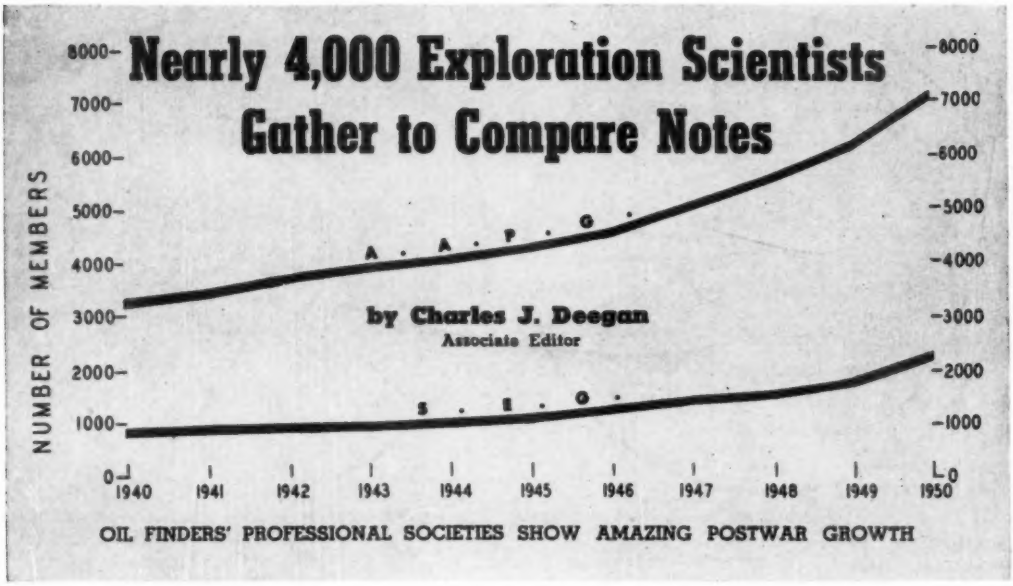
Fig. 5—(Below) Monthly variation in seismograph and gravimeter crew months in the United States.

Fig. 6—(Right) Comparison of discoveries and seismograph activity in the United States.





Nearly 4,000 Exploration Scientists Gather to Compare Notes



by Charles J. Deegan
Associate Editor

CHICAGO.—Reflecting the rapid postwar growth in membership shown in the chart above, a record-breaking attendance of nearly 4,000 exploration scientists has been attracted to this joint annual meeting of the American Association of Petroleum Geologists, the Society of Exploration Geophysicists, and the Society of Economic Paleontologists and Mineralogists.

Two major factors influenced this unexpectedly large attendance. First, the various programs have unquestionably set an all-time record for consistent high quality from start to finish. Second, the magic word "reef." Everybody wants to know more about reefs. Last year it seemed as though there was an unusual amount of interest in reefs. But last year's interest was a mere forerunner

E. DEGOLYER

Recipient of Sidney Powers Memorial Medal Award, A.A.P.G.'s highest honor for a petroleum geologist.

NEW S.E.G. OFFICERS

The winning candidates in the Society of Exploration Geophysicists election of officers for 1950-51 were announced as follows: President, George E. Wagoner, Carter Oil Co., Shreveport; vice president, Sigmund I. Hammer, Gulf Research & Development Co., Pittsburgh; secretary-treasurer, Francis F. Campbell, Amerada Petroleum Corp., Tulsa. The term of the editor, Richard A. Geyer, Humble Oil & Refining Co., Houston, elected last year, automatically holds over another year.

C. L. MOODY
President-elect
A.A.P.G.

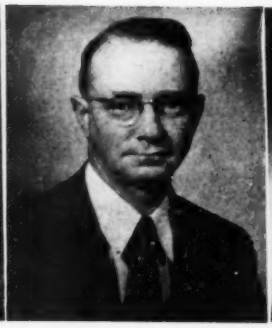
JOHN EMERY ADAMS
Vice president-elect
A.A.P.G.

HENRY N. TOLER
Reelected secretary-treasurer
A.A.P.G.

ALFRED H. BELL
Reelected editor
A.A.P.G.

GEORGE E. WAGONER
Candidate for president
S.E.G.

MAURICE EWING
Candidate for president
S.E.G.



SIGMUND HAMMER
Candidate for vice president
S.E.G.

DAYTON H. CLEWELL
Candidate for vice president
S.E.G.

FRANCIS F. CAMPBELL
Candidate for secretary-treasurer
S.E.G.

WILLIAM H. COURTIER
Candidate for secretary-treasurer
S.E.G.

RICHARD A. GEYER
Holdover editor
S.E.G.

J. C. KARCHER
Made honorary member
S.E.G.

of what by comparison, is now a tidal wave.

The higher average quality of the various programs, (and there are several sideshows in addition to the three main rings), can be attributed to an easing in the desperate pressure on available high-quality manpower during the war and in the postwar period. Now there is enough trained manpower available, and proven reserves are at last a shade above the danger point. So, exploration men can devote at least a few moments now and then to thinking about general principles and broad basic problems. The results show up here.

Undoubtedly one of the high points of the convention was the presentation of the Sidney Power Memorial Award of the A.A.P.G. to E. DeGolyer, in recognition of his distinguished and outstanding contributions to, and achievements in petroleum geology. This is the highest honor an exploration scientist can receive from those who know him best—his fellow members of the profession.

For distinguished service in the cause of geology, honorary member-

WILLIAM C. KRUMBEIN
President-elect
S.E.P.M.

GORDON RITTENHOUSE
Vice president-elect
S.E.P.M.

CECIL G. LALICKER
Reelected secretary-treasurer
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L. L. SLOSS
Program chairman
S.E.P.M.

M. M. LEIGHTON
Made honorary member
A.A.P.G.

E. RUSSELL LLOYD
Made honorary member
A.A.P.G.

FREDERICK M. SWAIN
Receives President's Award
A.A.P.G.

FRANK REEDY, JR.
Receives President's Award
A.A.P.G.

ships in the A.A.P.G. were bestowed upon Dr. M. M. Leighton, Illinois State Geologist, of Urbana; and E. Russell Lloyd, consulting geologist of Midland, Tex., and long-time associate editor of the A.A.P.G. Bulletin.

Upon Dr. J. C. Karcher, consulting geophysicist of Dallas, the S.E.G. bestowed its first award of honorary member since 1940, for distinguished service in the cause of exploration geophysics.

LEO J. PETERS
Receives Best Paper Award
S.E.G.

Four awards were made for papers published during the year, two by A.A.P.G. and two by S.E.G. The A.A.P.G. President's Awards for the most significant papers published by authors under 35 years of age, in the A.A.P.G. Bulletin during 1949, went to Frederick M. Swain, associate professor of geology, University of Minnesota, and to Frank Reedy, Jr., of Crown Central Petroleum Corp., Houston.

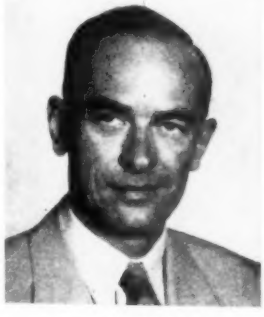
The S.E.G. annual Best Paper Award for an article published in its Journal during 1949, went to Dr. Leo J. Peters, Gulf Research & Development Co., Pittsburgh. An honorable-mention award in this class was given to F. J. Agnich, Geophysical Service, Inc., Dallas.

The various committee meetings scheduled, as shown at the end of this article, plus the general-session programs, which the reader may judge by the pages of abstracts following this article, are some indication of the amount of hard work that goes on from early Sunday morning to Thursday night.

The various committee reports that make up the symposium that is to lead to a revision of "Possible Future Oil Provinces of North America," an A.A.P.G. best-seller volume for nearly 10 years, are drawing good crowds. The symposium on "trapping components" is presenting some excellent material of great importance; the attendance reflects it.

But, as the jam-packed crowd at the Tuesday afternoon joint session on reefs showed quite clearly, everybody is interested in reefs. In the halls, in the lobbies, in the hotel rooms, inevitably the talk turns to

(Continued on page 127)



F. J. AGNICH
Hon. Mention, Best Paper Award
S.E.G.

The Presidents Speak

FREEDOM AND PETROLEUM GEOLOGY

by C. W. Tomlinson

WHAT part has freedom played in the development of petroleum geology in the United States? To a degree never before equaled on such a grand scale, we have honored here in America the principles of national and personal freedom, balanced by personal responsibility; of local self-government and individual ownership of property; of competitive private enterprise under rules of fair play to all.

Have these influenced the progress of our science? If so, have they been an obstacle or stimulant? Unquestionably, they have been a tremendous stimulant.

The achievements of petroleum geology, geophysics, and our allied sciences in the past 50 years have not altered basic scientific concepts as much as have those of physics, chemistry, and astronomy. But no science or profession except medicine can claim a greater share of the credit for increasing the comforts and the happiness of men.

By the use of the petroleum we geologists have found, millions of people have moved from the slums to the suburbs. Our people have been put on wheels or wings, given the pleasure of distant vacations, and the even more cherished privilege of week-end outings many miles from home.

Oil and gas have supplied the fuel for most of the vast upsurge in the use of power, with its many applications not only in domestic comfort and convenience, in better food and sanitation, but also in the industries which make the useful tools that achieve those ends. As they are acquired, these tools and comforts of modern life increase the productivity of men, make possible more leisure for them, and open opportunities to other men. The beneficient circle widens to assist all people.

In this half-century, annual production and use of oil in the United States has been multiplied by 30, and that of natural gas has had a parallel growth. Though proud of their profession and intensely interested in their work, petroleum geologists are so modest that few have dared, at any time in those 50 years, to predict such growth for more than a few years ahead. Which of us now would be more daring? In any branch of science, who can be sure of the undiscovered?

Less than 3 years ago predictions were heard that little if any increase in productive capacity could be expected in this country, even with higher prices for crude oil. But as has happened often before, the law of supply and demand did not fail us. The increased pace of exploration made possible by good prices, and by the postwar flood of well-trained young geologists and geophysicists, engineers, and paleontologists has more than kept pace with demand.

C. W. TOMLINSON
President, A.A.P.G.

National Security

The result is an excess capacity to produce oil here in North America, which is one of the hemisphere's most essential assets in event of war. The excess is perhaps not yet large enough for safety. But with vigorous competition, both international and domestic, it helped to bring a shrinkage in allowable yields per well and in profits, and a lull in the expansion of exploration; though demand still grows. At the first new hint of even a prospective shortage there will be another forward surge in exploration.

In this record of achievement for humanity, we must acknowledge that our exploratory sciences have been but one of many factors. The chemists in the refining industry have played an outstanding role. Nearly all branches of science have assisted. They can take pride that their studies have been put to useful service for mankind.

Perhaps even greater credit should go to the investors who have taken the risks we recommended; to the engineers, inventors, and industrialists who have developed and marketed equipment which employs our products; to the consumers who use them in ever-increasing volume; to those who have taught in our schools and colleges; and to the efficient workers in our industry and in industries which use our products.

Those who guard our health have had a part in it; and so have the churches which have kept us conscious of the Golden Rule, of the responsibilities that go with liberty. In fact, every constructive element in American life has helped make our achievement possible. And they have prospered with us.

But what part has freedom played in this great progress? It has been the life blood of the industry. Freedom of any man to search for oil in the United States and Canada. Freedom for any savings, foreign or domestic, to be invested here. Freedom of every farmer to obtain the best trade he can from anyone willing to pay for the privilege of exploring for oil on his land. Freedom of each of our many thousands of oil and gas producers to risk their savings in projects of exploration or development chosen on their own judgment or on that of their scientific employes. Freedom to advance, to grow, so long as one plays fair and does not trespass on another's rights. Freedom of the scientist to use to the limit his own imagination and ingenuity, to differ with other scientists. And how we do differ! And what great resources are found as a result! There is hardly an oil or gas producer in the United States who has not had the pleasing experience of succeeding in a venture which had been rejected by others in the light of differing judgment. And yet practically every producer has also rejected or overlooked ventures he had equal opportunity to make, in which another took the risk and won.

What old oil district has not seen newcomers arrive and find oil not found by those who knew the region best? In that free play of thought and of competition, and in widely disseminated ownership of subsoil rights, lies the chief key to the success of the United States in producing for nearly a century far more than its share of the world's oil.

We have not had greater resources than some other equal segments of the world. But we have found a larger part of what we had. We have developed them and put them to use, because we have kept open the doors of opportunity to every man who

(Continued on page 112)

The Presidents Speak

THE STATE OF SEISMIC PROSPECTING

by Andrew Gilmour

THE application of physics to the search for minerals and especially for petroleum began in earnest after the first World War. As Weatherby has stated in his excellent paper on The History and Development of Seismic Prospecting, "the stage had been carefully set and the players were ready to perform their new roles as prospectors." The men who designed, built, and assembled the equipment and the men who directed and carried on the early field operations could not draw on any background of experience but they had the educational background, the ingenuity, the industry, the interest, and the common sense which insured progress. As the years passed the progress was rapid. The amount of work done and the number of parties in the field expanded rapidly, but the improvement in instruments, the quality of the work done, and experience and ability in interpretation generally kept pace.

Then came the second World War. As an essential part of an essential industry, companies doing geophysical work were allowed to retain most of their supervisors, party chiefs, chief observers, and chief computers. But the men just under these ranks, in fact most of the other personnel, were prime material for the services. So that during the war field parties hobbled along with inferior personnel, little improvement in instrumentation, and often wornout field equipment.

Big Expansion

In spite of this, the number of seismograph parties in the field expanded, according to Eckhardt, from just over 200 at the end of 1941 to 350 at the end of 1945. The urgency of the war effort necessitated the expansion in exploration in order to insure the availability of adequate supplies of petroleum for that stupendous effort, even though that expansion entailed a large loss of efficiency. Taking into account the pressure on experienced personnel, the caliber and lack of experience of available help, the difficulty and delay in obtaining instruments and equipment or even in obtaining materials for the repair of instruments and equipment, the job done during the war years was one of which geophysicists can be justly proud.

After the war, the seismograph parties in the field continued to increase rapidly in number. At the end

ANDREW GILMOUR
President, S.E.G.

of 1948 there were more than 500 in the United States. That was more than two and one-half times the number in 1941. As stated above, the services had taken nearly all the junior men. Those were the men who, by education or experience or both, should have been ready and available for responsible positions when the expansion came. When the war ended these men had been out of geophysical work for 3 or 4 years. During that same period the colleges had not been turning out replacements. The result was that during the period of greatest expansion of geophysical prospecting there was an acute shortage of suitably trained technical personnel.

Seismic exploration has now pushed its way into those areas where obscure traps remain undiscovered because of their poor accessibility, their borderline value, or their lack of seismic distinction. In such areas low-relief structures must be painstakingly delineated. The differences in travel time on low-relief structure are often less than .01 second. To insure that such small differences are dependable, the instruments have to be designed, built and matched with great care and precision and the field operations have to be carried out in such a way that data obtained are of the highest quality and of the greatest accuracy possible.

Quality Standards

I submit that during the past 5 years many of our operations have not measured up to the standard that should be required and expected. Before the days of the expander or automatic control it was necessary to take several shots to cover the whole range of desired reflected times. The number of shots which had to be taken depended a great deal on the experience and ability of the observer and shooter. But with the introduction of the expander or automatic volume control, reflections could theoretically be picked from just beyond the first breaks out as far as sufficient energy persisted on the record.

Too often the observer decided that all he had to do was to shoot a very large charge of dynamite and move on to the next shot point. Frequently energy persisted on the record away beyond the time at which a reflection from the basement rocks should come in. The use of too much dynamite to bring in a given reflection lowers the contrast between the reflection and the noise on which it is superimposed, by stepping up the noise level. The result is a poor record. In an area where the quality is poor, the reflection may not be recognizable.

Poor Field Work

In many cases the expander or automatic volume control is built in to take effect before the first break, so as to make the lines appear steady. Then far too large a charge of dynamite has to be used to get the reflection level above the noise, resulting usually in a very poor or useless record. The expander or automatic volume control, when properly used, is of great assistance in getting good reflection data more cheaply by cutting down the number of shots and the number of holes required.

But it is too often used as a screen behind which poor instrument work, due to inexperience, lack of technical skill, or sheer laziness, can be hidden. Its misuse and consequent lowering of record quality should usually be blamed directly on the observer and party chief.

The effort to obtain better-looking records has led to use of multiple geophones and mixing. When a number of geophones, say 2, 5, or 10, are connected to a single amplifier and galvanometer, i.e., to one trace, without interconnection between the traces, the records are taken with multiple geophones. When the traces are interconnected, i.e., when the output of a geophone is fed into more than one trace, the records are "mixed."

The use of multiple geophones oft-

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en improves the quality of the records in areas where record quality is poor, provided the observer and his helpers keep the geophones in good condition. But it is much more difficult to keep 40 or 100 or 500 geophones in condition than it is to keep 10 or 20. Again the burden is on the observer and party chief. Mixing, like multiples, gives better-looking records, but increases tremendously the uncertainties in interpretation because a burst of energy on one trace may dominate all the traces into which it is fed.

The quality of the records and the interference pattern which is recognized as reflection character depend on the natural frequency of the recording circuit as well as on the attitude of and interval between reflecting horizons. When a survey is begun in a new area the observer should experiment with the available bands of frequency, that is, filter settings, to determine at which setting the reflection will come in best. Later, if reflection quality deteriorates he should experiment again to get the best result.

But any change in filter setting from shot point to shot point must be noted and corrected for because the change in filter setting will make a change in the reflection time picked and that change in time may be as great as the change due to structural relief. Again the result depends on the technical skill of the observer and party chief and on their appreciation of the fact that the time intervals on records from successive shot points must be comparable to a few thousandths of a second.

Too many records have been turned in with questionable time breaks and questionable up-hole times. A good time break is a necessary requirement of seismic prospecting because it is the base from which all the other times are taken. The weathering correction made by most operators depends on the up-hole time. There can be no excuse for the continued recurrence of poor time breaks and poor up-hole times. They show lack of skill and experience, or more likely, lack of interest in their work on the part of the observer and shooter. Poor time breaks and poor up-hole times are merely symptoms of poor workmanship and unreliable operations.

This discussion leads to the conclusion that the quality and reliability, as well as the amount, of the work a company gets from the seismograph party depends much more on the training and technical skill, on the experience, on the ability and industry, on the common sense and common honesty of the observer and party chief than it does on the eminence and reputation of the executives of the geophysical company or department. Close competent supervision of field operations certainly helps but the visits of the supervisor are periodic and cannot compensate for incompetence on the part of the men on the job.

The failure of geophysical surveys in the past 5 years to reach, on average, a satisfactory standard of quality and efficiency has been caused by the acute shortage of suitably trained technical personnel. Men with suitable educational background are again becoming available. Time and experience will give them the necessary skill and training. The exigencies of supply and demand can be expected, in their own hard way, to take care of inefficiency and incompetence. Laboratories are designing and building better and more sensitive equipment in sufficient quantity.

With high-quality personnel, using the best possible techniques, and the best equipment available, seismic prospecting may be expected to advance successfully into the more difficult areas still available for evaluation. It is our duty and our responsibility to see that it does.

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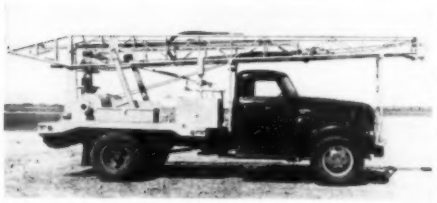

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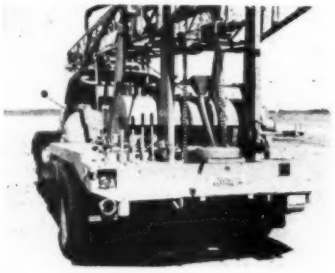

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Freedom and Petroleum Geology

(Continued from page 109)

had the vision and the energy to walk through.

The rapid growth of our domestic

market has been possible: (1) because the same freedom to seize opportunity existed for those who devised new ways to use our product; (2) because American devotion to freedom and to equal opportunity gave our whole economy a dynamic power of expansion unknown under monopolistic or totalitarian regimes; (3) because Americans were free to buy what they wished with their increasing purchasing power.

Our growth in service has not been the result of central planning, but a tribute to the lack of it. It is the fruit of freedom. No central planning body, no state monopoly or private cartel, could have accomplished half as much. Not even with the same personnel.

The freedom of that personnel in choosing exploratory projects and methods would have been restricted to conform to a single policy centrally determined. A single office would have controlled it all, in contrast to the many thousands who now choose such projects independently of all the rest.

When you mix an acid and an alkali in a test tube, no central planner (save God himself) lays out or coordinates the action which takes place. Each molecule seeks out its own opportunity for combination with another; and when it finds it, acts. There may be left a surplus of one type, but not of both. Every single possibility of action is utilized. Individual, chaotic action achieves the maximum result.

Has freedom also borne good fruit in terms of scientific progress? The answer lies partly in technical programs such as that of this convention. More fully, it is told on the shelves of our libraries and in those universities throughout the world. In perhaps no other branch of science do the publications of a single society comprise so large a fraction of the total literature of that science, as those of the American Association of Petroleum Geologists constitute in the literature of petroleum geology.

Consider also the publications of our friends the geophysicists and the paleontologists who have cooperated so helpfully with us through the years in the work of exploration and in these annual programs. Consider too the guide books, structural and stratigraphic sections, and periodicals made available to the science by our 30 affiliated local geological societies, largely composed of our own members.

Taken together, they contain the most inclusive and complete assemblage of subsurface geological data, of geology in three observed dimensions, that ever has been published.

The value of these publications lies in their usefulness to you and to all geologists. Perhaps no comparable set of volumes has been more fully used, or is more actively in use today. Testimony to that lies in every volume we have had to reprint to meet demand in later years; and in the constantly increasing number of copies required of everything we print.

Many companies and individuals have participated in preparing the symposiums of fact and thought that you will hear at this convention. If they wish they are free to withhold their own modicum of information; but they know they have far more to gain than to lose from free exchange of factual data.

It is recognized that in competitive private enterprise there is a commercial value in some types of newly acquired data or ideas, which one is fully justified in first applying to his own advantage if he can. The ability to do just that is the prime incentive and motive power in a free economy.

But in the great masses of information accumulated at private expense in our industry, there is little of real scientific value and of general interest which is not ultimately made available to all. Voluntary cooperation for the common good is typical rather than exceptional among us.

If we keep that spirit, and continue to cherish freedom and fair play rather than compulsion, our profession is only at the threshold of its greatest service to mankind. We have just begun.

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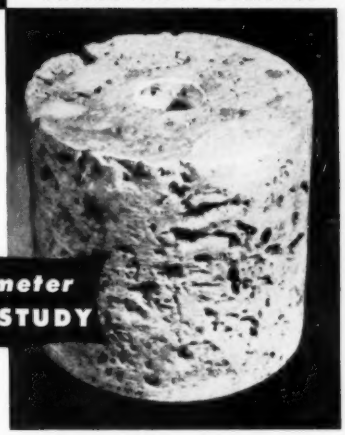

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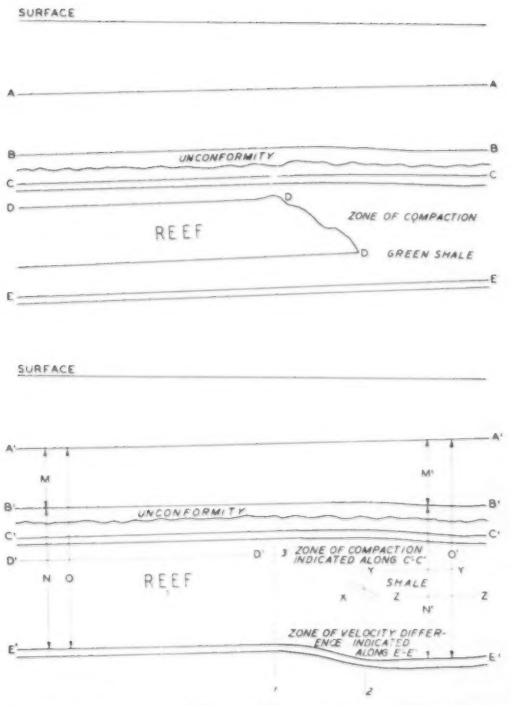


Fig. 1—(Left) Map of Alberta, showing area of difficult terrain.

Fig. 2—(Above) Cross-section study (modified somewhat for clarity) modeled after an east-west seismic cross-section through Redwater field.

Seismic Work Problems in the Canadian Bush Country

by W. J. Tellington*

IN the last year it has become clear that the problems presented to the geophysicists in western Canada are extremely difficult ones. Late in 1949, after a phase of active prospecting in the open plains of Alberta, a land play between Lesser Slave Lake and Fort Vermilion in Alberta brought oil men face to face with the problems of Canada's famous "bush."

We had learned to expect difficult drilling in the areas of glacial drift. We had employed bulldozers in cutting some lines and in cleaning snow, but we had engaged in a relatively small amount of road building. And we had come to expect considerable

*Geophysicist, Bear Oil Co., Edmonton, Alta., Canada.

This article is based in part on a talk given by the author at the S.E.G. Regional meeting in Dallas, November 18, 1949.

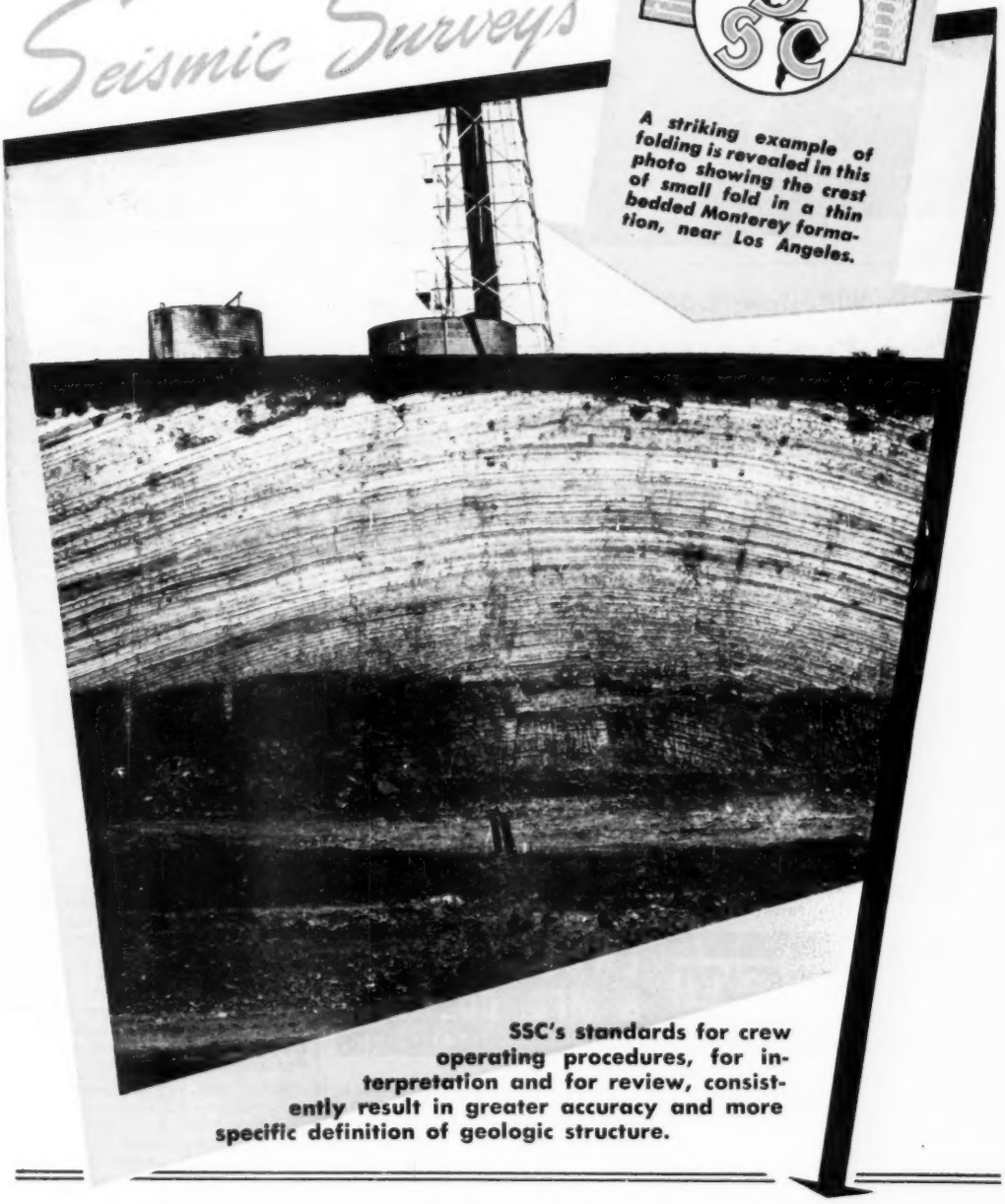
difficulties in the realm of seismology, due to the varying weathering conditions encountered together with the uniformly gentle dips recorded almost everywhere. Although the spring breakup left our vehicles immobilized because of the mud and gumbo, there was little point in trying to solve this problem because the use of the roads we were on during the long thawing period.

Suddenly we faced expensive road building in areas covered with heavy stands of timber, muskeg, "brule," (burned-over areas covered with old trees lying like jack straws on the ground). The use of standard vehicles was limited to a short period between December 15 and March 15, when temperatures dropped into subzero ranges for 40 to 50 days.

In approaching these problems the Bear Oil Co. staff first set about to assess its geophysical methods with the object of deciding what principles must be adhered to and what, if any, information could be sacrificed.

We have learned that when we discovered a "high" on a seismic contour map we should require some isopach change associated with it. We

Seismic Surveys



A striking example of folding is revealed in this photo showing the crest of small fold in a thin bedded Monterey formation, near Los Angeles.

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have specific ideas about the isopach maps we want.

Geologists seem to be of the firm opinion that we can expect little, if any, folding or other structural features of tectonic origin under the plains. Clear, steep dips are established in Redwater, Leduc, Stettler, Excelsior, and other fields. But all of these appear to indicate stratigraphic traps or local "reversals" associated with facies changes. The accompanying diagram is a cross-section study modeled after a seismic cross-section running east-west through Redwater field. Some liberties have been taken in determining the scale and magnitude of the changes in order to clarify the nature of seismic effect which can be observed on good records in most of the Devonian oil fields discovered to date in Canada.

In geologic interpretation a divergence, due to compaction below horizon B is readily observed. This should be revealed by the seismograph with no particular complications. Between horizon B and horizon E a convergence exists in the geology, but due to a variation in velocity between the reef and the shale environmental material this actual convergence is revealed by the seismograph as a divergence. The face of the reef or some talus slope associated with the face is responsible for the steep dip segments indicated by X. The seismic horizons indicated as Y-Y and Z-Z are probably related to bedding planes in the shale.

Top of Reef

Top point of the reef is indicated on the seismic interpretation by extending D′ D′ as shown until it intersects the vertical dash line at 1. This vertical dash line indicates the point where divergence is first noted on seismic records. Although the character change along D′ D′ is profound it is possible on the records to force a tie between this horizon and Y-Y. The basic geometry in a seismic interpretation can be stated as follows: M′ greater than M; N′ greater than N, and O′ greater than O. The evidence itself comprises isopach changes, steep dips, and character changes. Horizon C, indicated on these diagrams, is the D-2 limestone, and horizon D is the D-3 reef of western Canada.

Below the D-3 horizon geologists agree with few exceptions that there are opportunities to find oil. In a limestone tentatively identified by our group as D-4 some closures have been observed. It has been suggested that local faulting in that horizon might be discovered which would be associated with rapid changes in thickness of a salt horizon lying below it. Geophysicists can speculate about the nature of evidence which the seismograph should reveal under such circumstances.

Our group has accepted the idea that symmetrical anticlines with parallel bedding are rare, if they exist at all, within the area mentioned earlier. This allows us to concentrate our attention on isopach maps and cross-sections which will indicate isopach changes and equally important, reflection character changes.

Reflection character changes associated with facies changes at depth can also be influenced by surface changes. This brings us to geomorphology and topography. A careful study of character changes, together with details noted on standard seismic structure contour maps, can reveal the nature, areal extent, and magnitude of effect due to variations in the surface material and configuration.

Geophysical Procedure

We have adopted this following geophysical procedure:

1. For the isopach maps we need close orientation of reflections in the geologic section. Therefore, we drill a stratigraphic test hole first and obtain a velocity survey with a sufficient number of observations (usually over 30 shots at over 20 horizons in a 3,500-ft. hole) to apply an elementary statistical method.

2. For a preliminary study of the near-surface velocity changes we drill holes between 400 and 900 ft. deep, spaced at about 10-mile intervals. These holes are carefully shot for a velocity study and not infrequently logged by a geologist and followed by a radioactivity survey.

Comparing this seismic program to a topographic survey one might refer to the stratigraphic test as the base point and the 10-mile-spaced pattern as the first order network.

3. A network of township size loops recorded in a standard fashion joins the deep tests. This, together with character changes observed later gives adequate information with which to note surface and near surface effects.

4. Within the standard loops we shoot for isopach data only.

Fourth-Order Observations

Comparing again with topographic surveying we might call the network of standard lines our second or third order phase of established bench marks and corners. Then the isopach data would comprise the fourth order observations paralleling the plane table phase of a topographic survey.

The conception as outlined here has allowed us to modify our field operations considerably. We have encouraged the organization of a seismic team composed primarily of two sets of instruments. A regular crew working behind powerful hydraulic drills develops the network of township-sized loops. A "fly crew" working with very light equipment behind a 90-lb. power auger develops the internal isopach data. With this arrangement it is possible to get the volume of data from a team equivalent to two crews, and the cost of exploration is substantially reduced.

Our experience to date indicates that we can probably expect the work to progress smoothly during the spring, summer, and fall of 1950 at a cost of about $50 per profile, or $400 per mile. These estimates include all costs. There is only one reservation—record quality must be above average and interpretation must be both skillful and thorough.

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EXPLORATION SOCIETIES' ANNUAL MEETING

Digests

On this and the following several pages, the reader will find digests of most of the papers presented before the annual meetings of the A.A.P.G., the S.E.G., and the S.E.P.M. Meetings were held at Chicago, April 24-27. These digests are grouped according to type of subject matter or general relationship, rather than by individual societies.

Regional Discussion of Pennsylvanian Reefs of Texas

CARL B. RICHARDSON, Barnsdall Oil Co., Tulsa.

PENNSYLVANIAN reefs in western and northern Texas are known in an area of 50,000 sq. miles. They show a great variety of shapes and a wide stratigraphic range in their periods of growth. The reefs were formed far from major shore lines in an epicontinental sea. Some of the reefs adjusted themselves to sharp eminences created by early Pennsylvanian uplifts. There are numerous indications that other reefs may have indirect and offset relationships to gentle pre-Pennsylvanian uplifts and flexures.

Some reef fields have produced for many years but most of the fields and most of the reef information were developed since 1946. Pennsylvanian reefs in Texas now account for 8 major fields and more than 20 of less importance.

Structure-Forming Role of Limestone Reefs in Eastern Platform Area of West Texas

GERSON H. BRODIE, petroleum geologist, Abilene, Texas.

IT is shown in this paper that the sediments overlying limestone reefs drape themselves over and around the reef limestone anomalies probably through the mechanism of differential compaction and subsidence, with the result that shallow sediments commonly reflect the presence of a deeper sedimentary anomaly. Reef limestone masses, therefore, play a real structure-forming role even though they themselves are nonstructural in origin. Maps and cross-sections of North Snyder, Vealmoor, North Woodson, Eskota, and of other pertinent areas are presented to illustrate the thesis.

Geology and Geophysics Of North Snyder Area, Scurry County, Texas

NEAL CLAYTON, Republic Exploration Co., Tulsa.

A HISTORICAL resume of the geophysical surveys which led to the discovery of the North Snyder field is given.

Magnetic, gravity, and seismic data are offered to show the type of results to be expected from a reef mass of this type. Seismic records are shown which prove that in some parts of this field, a reef reflection is obtained.

Electric-log correlations are offered to illustrate the geology of the field. Evidence is introduced to prove that most of the draping over the North Snyder reef occurs within the Pennsylvanian shale section. Contour maps for the base of the Coleman Junction limestone and the top of the Canyon reef are shown.

Progress Report on Devonian Reef Exploration in Canada

W. J. TELLINGTON, Bear Oil Co., Edmonton, Alta., Canada.

THE problems of surface and subsurface as related to seismic problems in Redwater and other areas of Canada are discussed.

Paleogeographic Distribution And Classification of Reefs

L. L. SLOSS, E. C. DAPPLES, and W. C. KRUMBEIN, Northwestern University, Evanston, Ill.

AS an outgrowth of current regional stratigraphic studies, areas can be delineated in which significant contributions were made to sedimentation by biological agencies. These areas show all gradations from fossiliferous-fragmental limestone through biostromes to reefs. The occurrences are analyzed in terms of their distribution in the United States through geologic time, within their framework of contributing organisms, and environmental and tectonic controls.

Analysis of the data demonstrates that reef areas occur under certain combinations of favorable conditions. These involve the coincidence of superposition of biologic, physico-chemical, and tectonic factors. A demonstrable relationship between combinations of these factors and the distribution of reefs can be shown by mapping techniques.

A byproduct of this analysis leads to several categories of reef classification: (1) geometry of reef form and size; (2) geometry of reef distribution; (3) relation to distribution of organic environments; (4) relation to lithologic associations and depositional environments; (5) relation to tectonic stability or rate of subsidence.

Some Physical Aspects of Ancient Reef Complexes

ROBERT R. SHROCK, Massachusetts Institute of Technology, Cambridge.

THE present widespread interest of petroleum geologists in ancient organic reefs or bioherms justifies thorough examination of these sedimentational structures from every possible point of view. Detailed studies of modern reefs are certain to throw light on many problems concerning biohermal construction; likewise, a better understanding of ancient reefs will surely help the person investigating modern ones. However, similarities and differences shown by modern and ancient reefs cannot be fully demonstrated until we pool our ideas, observations, and data. It is for this specific purpose that the present symposium was organized.

Several aspects of bioherms and of biohermal or reef complexes seem worth notice. (1) The configuration of the upper surface and of the foundation on which reef building started should be interesting to both sedimentologist and geophysicist. (2) The three-dimensional distribution of bioherms in a complex is important, and likewise, the way in which adjacent bioherms die out peripherally or join with a neighbor. (3) Regional relations of biohermal and nonbiohermal sequences deserve more study, looking to the signs and relationships that might indicate where biohermal structures may be expected. (4) Differences and similarities in physical properties of the rocks making the complex need to be fully investigated. Considering the reef core, the surrounding halo of detritus, and the fine-grained well-bedded rocks of the interreef areas, what differences exist in porosity, permeability, bedding, jointing, elemental and mineral composition, trace element content and distribution, radioactivity, et cetera? Can any of these be used to locate position in a biohermal complex? (5) The fossil assemblage differs from place to place. Much more careful work on paleoecology is needed to match the ever-growing mass of excellent ecological data coming especially from the Pacific reefs.

More than ever before the time seems now at hand for those interested in reefs of all kinds to leave the libraries, laboratories, and symposial halls for a little while and go visit the reefs that are abuilding, those that were built recently, and those that were constructed long ago.

Reef Sedimentation— Majuro Atoll

SHERMAN A. WENGERD, University of New Mexico, Albuquerque. (Presented by title only.)

MAJURO ATOLL is a typical Pacific coral mass in the Radak (East) chain of the Marshall Islands. The coral atoll is an

isolated variable environment of sediment production and deposition. A 4-month study was made to appraise the geologic and geographic factors controlling reef sedimentation.

As in most coral atolls, coral is only one source of calcitic debris. Calcareous algae, pelecypods, and gastropods are plentiful. In cross-section, the atoll environment from the ocean to the lagoon comprises the fore reef bench, the outer reef with crevices, the tidal pool zone, the reef flat, the reef-flat coral fringe, the beach rock zone, the lagoonal coral head zone, and the lagoon floor.

Sedimentation in this atoll environment varies, dependent on: the orientation of the atoll; prevailing winds; position, size, and depth of the passes; strength of reef growth; oceanic currents and waves; and possible late tilting of the atoll.

Geographically, the sedimentational environment shows a major source of clastic supply from reefs being destroyed on the east and northeast sides of the atoll. This source supplies sediment through the destruction of both ancient and modern coral. The greater number of these sediments are dissolved and carried to sea, or eventually deposited os clastics on the beach ridges of the leeward islands where they are stabilized by vegetation, or deposited in the lagoon. Some solution and redeposition occur as the lagoonal sediments are slowly shifted on the warmer lagoon bottom.

Specific localities of sediment deposition on the atoll thus include the coarse rubble zone oceanward from the outer reef, narrow crevice fillings of medium to coarse sediment in the outer reef, fine to medium sediment in the tidal pools, islet beach ridges, islet inwash plains, lagoonal bars flanking the passes, debris around the lagoonal coral heads, and the sludge of the lagoon floor.

Sedimentation on the coral atoll is thus highly variable as to source, transport, and final deposition. Lateral gradation in clastic size must be studied in terms of source, circuitous but local travel, and the specific reef locale of deposition. Variations in porosity and permeability must be attributed not only to diagenetic changes in calcitic debris and lithology of the superjacent sediments which may cover the reef, but consideration must as well be given to the origin of the clastics and their specific depositional environment within the atoll.

Significant Gravity Pattern In Reef Anomalies

RICHARD A. POHLY, United Geophysical Co., Inc., Terre Haute, Ind.

THE observed gravity anomalies on reefs of different ages and depths are shown to have a common identifying pattern consisting of a central gravity maximum with a surrounding minimum. Variations in the relative intensities of these components can account for the confusing evidence that reefs produce gravity anomalies which are in one case predominantly maximum, and in another, predominantly minimum. Density and velocity data are introduced to account for these variable intensities and to support the reliability of the pattern in reef interpretation. Specific examples of gravity anomalies on known reefs are presented and discussed. Recommendations are made regarding field procedure and residual methods.

Types of Oil and Gas Traps in Rocky Mountain Region

ALEX W. McCOY, III, Phillips Petroleum Co., ROBERT L. SIELAFF, Sinclair Wyoming Oil Co., H. W. BASS, U. S. G. S., GEORGE R. DOWNS, Carter Oil Co., JOHN H. MAXSON, Anderson-Prichard Oil Co., all of Denver.

OIL and gas traps in the Rocky Mountain region are classified as: anticlinal, permeability, pinchout, fault. Nine fields illustrating diverse trap types under these major classifications are discussed and depicted by structural maps and cross-sections. The relative commercial importance of each trap type and age of producing reservoirs are compared in a series of maps and bar graphs. Relative importance and trends of discovery methods are also examined. Conclusions are drawn regarding most productive types of traps and the best methods for their discovery.

Types of Oil and Gas Traps in West Texas and Southeast New Mexico

J. H. BARTLEY, University Lands, and R. T. COX, Atlantic Refining Co., Midland, Tex.

OIL and gas accumulations in the West Texas-Southeast New Mexico area are recognized as occurring in five types of traps.

1. Anticlinal trap reservoir, being due to structural convexity and completely surrounded by edge water, with the porosity extending throughout the reservoir rock with slight modifications in some places by feather-edge porosity and faulting, or by either.

2. Permeability trap reservoir, the periphery being partly delineated by edge water and partly by loss of permeability in the reservoir rock, all of which can be modified by convexity.

3. Pinchout trap reservoir, the periphery being partly defined by edge water and primarily defined by pinchout of the reservoir rock by either nondeposition, truncation, or overlap, and in some places associated with convexity.

4. Fault-trap reservoir, being that type wherein the periphery is defined by a fault and edge water.

5. Reef-trap reservoir, the periphery being defined by lateral disappearance of "reef type" deposits.

A total of 445 fields are classified, of which 139 are anticlinal-type traps, 234 permeability-type traps, 34 pinchout-type traps, 3 fault-type traps, and 35 reef-type traps. Of the reef-type traps, 20 are Pennsylvanian in age, and the remainder are Permian.

There are 22 major fields in the West Texas-New Mexico area with estimated ultimate production of 100 million barrels or more. Eight of these major fields, which represent 1.8 per cent of the number of fields in the area, are of the anticlinal-type trap, and had recovered 44 per cent of the total oil produced from the major fields as of January 1, 1950.

Types of Hydrocarbon Accumulation and Geology of South Liberty Salt Dome, Liberty County, Texas

MICHEL T. HALBOUTY, consulting geologist and petroleum engineer, and GEORGE C. HARDIN, JR., assistant geologist, Houston.

BEDS of Tertiary age in the Gulf Coast of Texas and Louisiana constitute one of the most prolific producing provinces in the world, yet there is little regional folding and an absence of large tectonic movements, and therefore no major structural features of great relief which characterize many other oil-producing provinces. The Gulf Coast was, and still is, an area of low relief, both inside and beyond the coast line, with deposits through the Tertiary made up principally of continental beds and of sediments deposited in shallow marine waters, with a series of regressions and transgressions with the net effect of moving the shore line toward the south. During these oscillations there occurred erosional periods and consequent minor, but effective, truncation of beds and traps for accumulation of oil and gas.

Despite the absence of structure of great relief, accumulation of hydrocarbons is present in the Gulf Coast in less intense features of every known type: anticlines, faults, faulted anticlines, sand lenses, stratigraphic traps of all types, reefs, and a combination of these structural and stratigraphic forms.

The general progressive and thick deposition during the Tertiary in this large Gulf Coast homocline amounting to a total of 50,000 ft., has been responsible for certain structural features among which the most outstanding are the salt domes. The motive force of the uplift of these domes has been the static weight of the thick Tertiary sediments, so that the great vertical growth of the domes has taken place during the Tertiary.

The various types of hydrocarbon accumulations have been proved by drilling on the Gulf Coast salt domes, and one of them, the South Liberty salt dome, in Liberty County, Texas, 45 miles east of Houston, is the subject of this paper, because it exemplifies the economic importance of various types of oil traps which were formed at several stages in the growth of the dome. This field is now being extensively and successfully explored for additional producing zones.

Types of Oil and Gas Traps in Southern Oklahoma

ERWIN L. SELK, Stanolind Oil & Gas Co., Oklahoma City.

THE oil and gas accumulations in the oil fields of southern Oklahoma are principally associated with the structure and stratigraphy resulting from two major orogenic movements in Pennsylvanian time, and minor movements in Permian and post-Permian time.

The vagaries of entrapment of hydrocarbons in the various geological horizons are manifest in subsurface maps and cross sections of the developed oil fields. A review of several of these fields in this perspective reveals the types of oil and gas traps generally found in southern Oklahoma, which may serve as a guide in developing ideas for exploration in this and other provinces.

Oil and Gas Traps in California

JOHN C. HAZZARD, Union Oil Co. of California; R. R. SIMONSON, Ohio Oil Co., P. H. DUDLEY, consultant, H. W. WEDDLE, Standard Oil Co. of California, D. M. DAVIS, Union Oil Co. of California, all of Los Angeles.

CALIFORNIA has produced an estimated 8,320,000,000 bbl. of oil in 85 years of commercial production. In this figure it is surpassed only by Texas. The petroleum reserves of California are estimated at 4,430,000,000 bbl., which will come from 180 recognized oil and gas fields, and 42 dry-gas fields. These producing areas are divided among five sedimentary basins, and with the exception of 27 fields which produce only dry gas, all oil and gas are produced in the southern half of the state. The producing area of all fields totals approximately 300,000 acres. For the purpose of a statistical summary, these oil and gas fields are classified as anticlinal traps, fault traps, and stratigraphic traps. Where more than one type of accumulation is recognized in a field, it is arbitrarily classified on the basis of the trap believed most important. Reef and salt-dome accumulations are not present in California.

From the standpoint of oil production and reserves, the relative importance of these traps is (1) anticlinal, (2) stratigraphic, and (3) fault. Of the oil produced to January 1, 1950, the anticlinal fields have contributed about 5½ billion barrels, or approximately two-thirds of the state total. Stratigraphic accumulations have produced about 2½ billion barrels, and fault traps approximately 345 million barrels. All reservoirs are in sands or fractured rocks and

no limestone reservoirs occur. Most of the California production is from reservoir rocks of Tertiary age, with a very minor amount found in Cretaceous and fractured basement.

For the purpose of illustration of the types of accumulation in California, the following four fields have been chosen for more detailed presentation: Santa Fe Springs—anticlinal; Poso Creek—fault; East Coalinga—stratigraphic pinchout; and Pleasant Valley—stratigraphic (permeability barrier).

Geophysical Case History of Delhi Field, Northeast Louisiana

W. E. HOLLINGSWORTH, Sun Oil Co., Beaumont, Tex.

A SPREAD of acreage was taken across the area in 1940 and 1941. This leasing was done on geological evidence obtained in the few wells that had been drilled. These wells indicated the possibility of stratigraphic traps in the area.

Seismograph work was started in 1944 with a Petty Geophysical crew doing about 4 months work in the area. A test was located in Section 21, T-17n-R9e, in the latter part of 1944 and production was established from Paluxy of Lower Cretaceous age on December 9, 1944.

Fort Cobb Anticline—A Geophysical Case History

FRANCIS F. CAMPBELL, Amerada Petroleum Corp., Tulsa.

THE Fort Cobb anticline is in 8n-12w, Caddo County, Oklahoma. Its history is one of geophysical success and commercial failure. Amerada Petroleum Corp. found clean-cut seismic evidence of a large closed structure and drilled a 10,000-ft. dry hole on top of it. Then Superior Oil Co. of California shot the area and drilled two more tests. The first Superior test was drilled to 17,800 ft. and was the deepest test in the world at the time. The presentation of data includes reproductions of seismic records, cross-sections, and structural maps on three horizons.

Case History of Benton Field, Bossier Parish, Louisiana

STEFAN VON CROY, Barnsdall Oil Co., Tulsa, and CLAUDE N. VALERIUS, consulting geologist, Shreveport.

A REGIONAL gravity-meter survey executed during the summer of 1943 along the eastern slopes of the Sabine uplift indicated the presence of a prominent minimum trend.

The first traverse of a subsequent reflection seismograph survey in portions of Townships 20 and 21 north, Ranges 12 and 13 west, Bossier Parish, Louisiana, revealed strong critical west and north dips after which the Benton structure was delineated by a moderate amount of seismograph work.

Geophysical maps of the raw gravity configurations and two seismic control horizons are presented. A comparison of the base of the anhydrite control with the deeper seismograph horizon, later identified to be somewhat below the Bodcaw sand of the Cotton Valley series, demonstrates the shifting of the structural axes down dip with increased depth.

The discovery well on the apex of the structure and 16 other development wells confirm the outline of the seismic Cotton Valley picture. The structure is an elongate anticline approximately 7 miles long with an average width of $2^{1}/_{4}$ miles. Although only 60 ft. of closure on the "D" sand has been proven by drilled wells, it is evident that total closure must exceed 100 ft.

The history of folding of the Benton structure reveals interesting comparison of the results of the local causative forces as opposed to the effects of regional tilting due to the Sabine uplift.

The remarkable accuracy of the seismic data was chiefly responsible for the unusual development following discovery of the field which resulted in early unitization of leaseholds which later included mineral and royalty interests, thus allowing very economical drilling costs and proper spacing and location of wells to secure efficient drainage.

Geophysical Exploration in Northern Alaska

HERBERT HOOVER, JR., and HOWARD MYERS, United Geophysical Co., Pasadena, Calif.

THE special operating problems encountered during exploration of Naval Petroleum Reserve No. 4 which covers an area of 36,000 sq. miles in the vicinity of Point Barrow, Alaska, are outlined; and the measures taken to successfully overcome them are described. The results of the geophysical operations to date are summarized and case histories of several prospects are presented.

The Advantage of Airborne Over Ground Magnetics for Purposes of Interpretation

H. WAYNE HOYLMAN, chief geophysicist, Fairchild Aerial Surveys, Inc., Los Angeles.

PART 1 outlines the general theory of the earth's magnetic fields, with exhibits to illustrate the difficulties encountered in obtaining reliable data with the ground magnetometer as compared with the airborne instrument.

Part 2 discusses the interpretation of the data based on the method of direct approach. The exhibits show the advantage of the second derivative (computed analytically) as compared to a residual picture in detecting anomalies related to basement topography.

Air-Blast Symposium

W. T. BORN, Tulsa Geophysical Society, Geophysical Research Corp., Tulsa.

A DIGEST of seven papers given before the Geophysical Society of Tulsa by the following speakers: John W. Daly, Honolulu Oil Corp., Midland, Tex.; D. Ray Dobyns, Magnolia Petroleum Co., Dallas; E. J. Handley, Century Geophysical Corp., Tulsa; W. O. Novelly, Republic Exploration Co., Tulsa; Dr. R. A. Peterson, United Geophysical Co., Pasadena; Dr. T. C. Poulter, Southwest Institute of Inventive Research, San Antonio; and C. M. Ross, Amerada Petroleum Corp., Tulsa.

Representative conventional and air-blast records taken in many different areas are presented and the results briefly discussed.

Geophysical Data on the North Carolina Coastal Plain

D. C. SKEELS, geophysicist, Standard Oil Co. (N.J.), New York.

GRAVITY, magnetic, refraction seismograph, and reflection seismograph maps are presented, which are the result of surveys conducted on the Coastal Plain of North Carolina (and extending into Virginia) by Standard Oil Co. of New Jersey (now Esso Standard Oil Co.) in 1944-46. The gravity and magnetic maps show maxima and minima, elongated in a generally north-south direction, which are believed to indicate the grain of the crystalline rocks of the basement. Scattered refraction profiles show the regional eastward dip of the basement surface, with an indication of a regional nose in the northern part of Dare County, North Carolina. Discrepancy between the refraction map and the known depth of the basement in the Hatteras Light test indicates that for the eastern part of the area the high velocity horizon whose depth was mapped by refraction was not true basement. The reflection survey of Pamlico Sound and adjacent islands shows regional east dip, on which are superimposed a number of noses trending slightly north of east. North Carolina Esso No. 2 was drilled on one of these noses.

Microwave Shoran

FRANK C. ALEXANDER, JR., Gulf Research & Development Co., Pittsburgh.

THE shoran system of radiolocation is briefly reviewed. The salient features of a microwave system operating in the 3,000-megacycle region are described and illustrated by diagram. Photographs of the equipment are shown.

Sand Extension Measurements From Gas and Oil Wells

DR. F. W. LEE, geophysicist, Baltimore Field Unit, U.S.G.S., Baltimore.

THIS paper aims to give a brief historical review of experiments on which is founded the system of in-well electrical measurements for measuring sand extensions about a well. There is presented an outline of the theory upon which such measurements are made and means for making observations in the field. Results of some field tests on the Berea and Clinton sands in Ohio using this method are shown.

Reflected Energy Variations Resulting From Small Changes in Shot Hole and Spread Locations

CARL H. SAVIT, Western Geophysical Co., Los Angeles.

EXAMPLES of seismograms and cross-sections are presented to illustrate changes of considerable importance resulting from relatively minor displacements of shot holes and spreads. Records and cross-sections are exhibited from continuous profiling lines which were shot from separate lines of shot holes on opposite sides of a single line of spreads as well as from lines which were shot from a single line of holes but which were recorded simultaneously on separate parallel spreads. A comparison of the results of conventional spread arrangements and of the parallel line of "H" spread technique as used in difficult areas is made.

Dispersion in Seismic Surface Waves

MILTON B. DOBRIN, Magnolia Petroleum Co., Dallas.

THIS paper reviews the published theories and observations on dispersion (variation of velocity with frequency) in surface waves from earthquake and in water-borne waves from shallow-water explosions and cites two further instances in which dispersion theory has been used in analyzing seismic data.

In the seismic refraction survey of Bikini atoll, information on the first 400 ft. of sediments below the lagoon bottom could not be obtained from ground wave first arrival times because shot-detector distances were too great. Dispersion in the water waves, however, gave data on speed variations in the bottom sediments which

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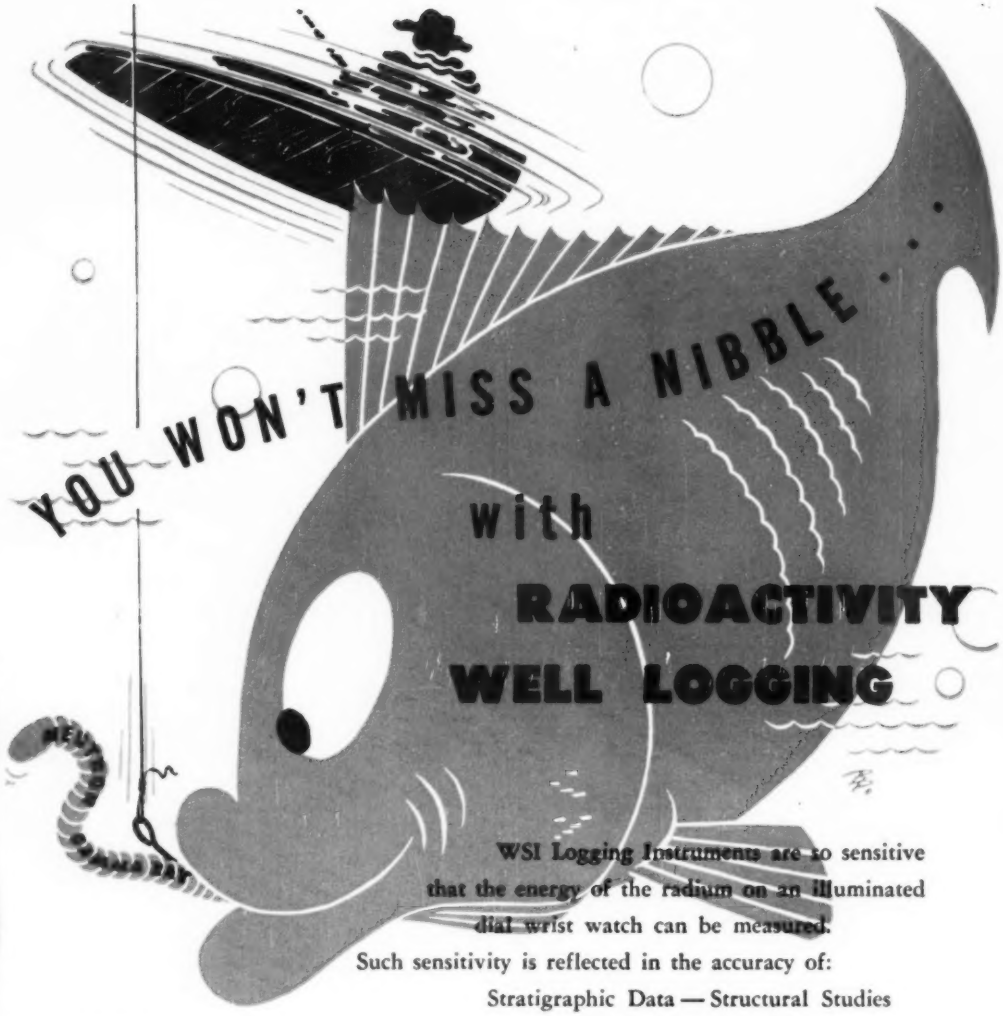

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made possible inferences on the recent geological history of the atoll.

Recent systematic observations on ground roll from explosions in shot holes have shown dispersion in the vertical component of the surface waves which is similar in many ways to that observed in Rayleigh waves from distant earthquakes. Classical wave theory attributes Rayleigh wave dispersion to the modification of the waves by a surface layer. In the case of earthquakes, this layer is the earth's crust. In the case of waves from shot holes, it is the low-speed weathered zone. Jeffreys' formula for Rayleigh wave dispersion, which agrees well with observation in the earthquake case, also agrees with ground roll data if the thickness of the weathered layer is substituted for that of the crust. Additional experimental and theoretical study of this type of surface-wave dispersion may provide useful information on the properties of the surface zone and add to our knowledge of the mechanism by which ground roll is generated in seismic shooting.

The Second Derivative Method Of Gravity Interpretation

THOMAS A. ELKINS, Gulf Research & Development Co., Pittsburgh.

THE theoretical formula by which it is is possible to compute the second vertical derivative of a potential function from its values in a horizontal plane is derived for both the two-dimensional and the three-dimensional cases. The graphical method of computing the second derivative is discussed, especially as to sources of error as well as a least squares coefficient equivalent of the graphical method.

Formulas and graphs for the second derivative effect of such geometrically simple shapes as the sphere, the infinite horizontal cylinder, the semiinfinite horizonal plane, and the vertical fault, are presented with discussions of their value in the interpretation of practical data. Finally, the gravity and second derivative maps of portions of some important oil provinces are presented and compared to show the higher resolving power of the second derivative.

Density Determination by Underground Gravity Measurements

SIGMUND HAMMER, Gulf Research & Development Co., Pittsburgh.

SINCE density contrast is the fundamental quantity on which all gravity prospecting depends, no argument for the need of density information is necessary. Heretofore, the scant density information which is available on subsurface rocks has come from measurements on well cores and cuttings and from projecting underground the results of measurements on surface rocks. These data, while valuable, are subject to serious uncertainties and practical limitations. Density determinations from underground gravity measurements have the advantage that they give the integrated bulk density of the rocks, in place, which is the quantity of fundamental importance in gravity prospecting.

The design and construction of a bore-hole gravimeter, of sufficient sensitivity and range, present formidable instrumental problems. Therefore, measurements with a standard Gulf gravimeter were made in a vertical mine shaft, 2,260 ft. deep, to simulate the data which would be given by a bore-hole gravimeter. These results will be reported in detail.

A detailed geologic log of the section penetrated by the mine shaft is available. Also, samples of the excavated rocks were secured, and their densities were measured for comparison with the density log calculated from the gravimeter data. Comparison of all these results shows that the gravimeter data clearly and accurately delineate the density variations in the section.

The Case for Gravity Data From Boreholes

NEAL J. SMITH, geophysical division, The California Co., New Orleans.

THE immediate urge for gravity-meter surveys in bore holes is the desire to improve the resolving power of the gravity method itself, but there are other potential uses for data so obtained. Bore-hole gravity surveys, through the influence of density, would be related to numerous important rock properties, notably the velocity of seismic waves, the coefficient of reflection, electrical resistivity, lithology, porosity, and the state of the fluid in the rock. Therefore, the data would bear upon seismic techniques and, depending on accuracy and completeness, upon the interpretation of lithologic and electric logs.

The more obvious of the possible uses are indicated and some of the problems and inherent limitations holding up the method are discussed.

Exploratory Drilling in 1949

F. H. LAHEE, Sun Oil Co., Dallas.

DURING 1949, 9,058 exploratory holes were drilled in the United States. Of these, 4,449 were new-field wildcats, 2,457 were new-pool tests (including new-pool wildcats, deeper-pool tests, and shallower-pool tests), and 2,152 were outposts. Among the new-field wildcats, 506 were successful; among the new-pool test, 656 were successful; and among the outpost, 658 were successful.

The total exploratory footage drilled in the United States in 1949 was 34,798,291 ft. in the 9,058 holes, or 3,842 ft. per hole. These figures are comparable with 32,741,097 ft. drilled in 8,013 exploratory holes, with an average depth of 4,086 ft., in 1948. For the second time, this year data on Canada and Mexico are presented.

Red Beds and the Search for Oil

GORDON RITTENHOUSE, University of Cincinnati, Cincinnati.

IN the northern Appalachian basin, the relationship between some red beds and the occurrence of oil and gas appears to be more than coincidental. An understanding of this relationship may be useful in exploration elsewhere.

Much of the production from the "Clinton" and upper Devonian of the northern Appalachian basin is from gray sands that occur just below, above, or west of the Grimsby and Catskill red beds. Apparently, clastics from an eastern source were transported westward by rivers, and were deposited in part as subaerial "deltaic" red beds. In part the clastics were carried to the sea where the sand accumulated in porous nearshore deposits and the silt and clay were deposited farther from the shore. Regression of the shore line resulted in red beds being deposited above the gray sands; later transgression caused gray sands to be deposited above the reds.

Other red beds, notably the Queenston of Upper Ordovician age and the Rochester equivalent of early Silurian age, although of the same general shape, thickness, and origin as the Grimsby and Catskill, have no associated gray sands and no production of oil and gas. These red beds contain no red sands near their pinchout margins. Probably no sand that could form oil and gas reservoirs was transported as far as the shoreline.

It seems probable that other deltaic type red beds that contain red sands near their pinchout margins may have peripheral gray sands in which oil or gas may occur.

Geosynclinal Deposits in Central Gulf Region of United States

GROVER E. MURRAY, Louisiana State University, Baton Rouge.

MORE than 30,000 ft. of Mesozoic and Cenozoic sediments are present in the central gulf region of southern United States. They constitute a great sedimentary complex (Gulf Coast geosyncline) composed of marine and deltaic deposits. The deltaic sediments occur as overlapping ladle-shaped and irregularly lenticular masses with areas of maximum accumulation (depocenters) in general parallel with the coast line; individual deltaic masses coalesce to form elongate, geosynclinal, deltaic complexes. Thin marine strata are present between the deltaic depocenters; thick marine sediments occur on the seaward edges of the deltaic masses. Landward, currently updip, both the marine and deltaic units are replaced by marginal and fluviatile deposits; seaward, the marine facies are deeper-water and the deltaic facies are more marine. Primary depositional stages coincide with major fluctuations complicate the sedimentary history of the area.

Isopachous and structural studies show that depocenters and axes of maximum deposition shifted from time to time in position and alignment but progressed generally in a seaward direction. Major interruptions of the seaward progression occurred in the Cretaceous and Tertiary.

Volumetric calculations, the stratigraphic and sedimentary history of the area, and Recent geologic events indicate that subsidence has been a major factor in creating a linear, arcuate geosyncline in the coastal plain of the United States.

Postwar Exploration for Petroleum in Japan

GODFREY F. KAUFMANN, Standard-Vacuum Oil Co., New York.

THE Japanese Islands are part of an exceedingly active orogenic belt and have been subjected to almost continuous geotectonic movements since late Cretaceous time. Oil fields have been developed in a few small landward remnants of two extensive sedimentary basins which extend along the northwest side of Honshu and along the coast of northwestern Hokkaido.

Three, small, structural complicated basins in northwest Honshu and the northwest Hokkaido basin contain more than 50 small fields. Development began in 1874, and production reached a peak of more than 8,000 bbl. per day in 1916. However, another peak was reached in 1937 when the Yabase field of the Akita district, discovered in 1934, reached its maximum production. A steady decline in production reached its lowest point in 1948 when the daily average production for Japan dropped below 3,000 bbl. per day.

As a result of the application of sound technological methods to the search for new production in the postwar period, extensions of oil-producing fields, and new discoveries in deeper zones of Yabase field have reversed the downward trend in production. At the end of 1949 the oil production of Japan was more than 4,000 bbl. per day.

Lithologic Facies of Jacksonian Stage, Central and Eastern Gulf Coast

GROVER E. MURRAY, Louisiana State University, Baton Rouge.

UPPER Eocene deposits usually referred to the Jackson group are more properly assigned to the Jacksonian stage. Lithologically distinct and mappable sequences of strata within the stage limits are considered as rock groups.

Sediments of the Jacksonian stage in the

(Continued on page 172)

GEOLOGICAL MAP
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Geophysical Activity

(Continued from page 105)

have borne the brunt of 31.29 per cent reduction in the total of gravity work done in the United States in 1949 as compared to 1948. The Rocky Mountain states bounced up to 29.95 per cent of the total, but this accomplishment resulted from merely maintaining the crew-months of gravity work at substantially the same level as the year before.

Magnetometer operations during the year were appreciable in magnitude for both ground and air surveys and widespread geographically. Unfortunately, the data available are too sketchy to justify conclusions as to magnitude of total activity or as to trends.

The month-by-month variation in the number of seismograph and gravimeter parties in the United States over the past 10 years is shown in Fig. 5. While the legend for the ordinates of this figure is "Number of Parties," a more accurate statement would be "Crew (or Party) Months." The graph shows the number of seismograph parties at the end of 1949 to have been 427. In a very recent publication, this number was given as 365, a substantially lower figure. This discrepancy caused some concern until it was discovered that the published breakdown included no crews for North Texas. According to the records on which the report here presented is based, there were 54 crews in the overlooked area in December 1949. This accounts for all but a small part of the difference.

Gravimeter Activity Down

As was the case a year ago, the gravity figures for 1949 have not been available on a month-by-month basis for all areas. The only figures available were the crew-months for the entire year. This permitted the computation of the average number of crews employed during the year, which average is indicated by the horizontal dashes on the chart. The dotted curve was judiciously drawn through the averages for the year. On the basis of the crew months reported for the last 2 years, gravimeter activity in the United States in 1949 was down 31.3 per cent from the year before, to the lowest level of almost 7 years.

In the entire history of the industry, discoveries of oil in excess of 3 billion barrels have been made in the United States in only 5 years, 1929, 1937, 1938, 1948, and 1949. It is to be noted that none of these were war years. While the addition to net reserves was greatest in 1937, the quantity of oil discovered was a maximum in 1948. Last year was the third-best discovery year the industry has experienced. The success of

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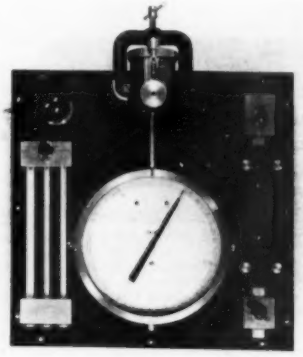

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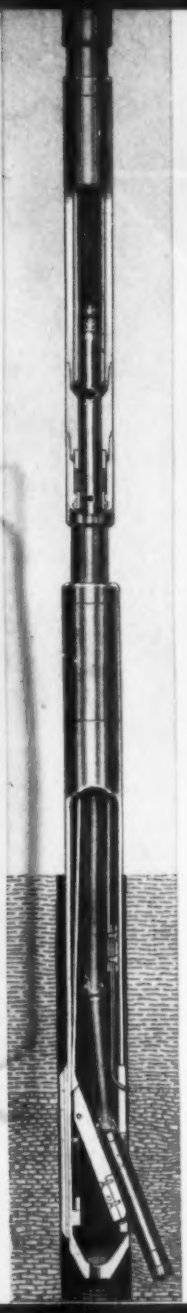

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exploration during the past 2 years has no doubt given rise to a more comfortable feeling about the adequacy of future supply which, together with other factors, has contributed to a relaxing of the exploration effort.

For a parallel to the precipitous drop in seismograph operations, which took place last year in the United States, one has to go back 12 years to 1937. Fig. 6 is presented to show this and the relationship between annual discoveries of crude oil and the concurrent volume of seismograph operations. Discoveries in part replace the oil which has been produced and in part provide net additions to the remaining reserves. It is quite obvious that there is a strong correlation between seismograph operations and discoveries. The closeness of the correlation is especially striking since other very important factors very decidedly affect the magnitude of the discoveries. For example, not a barrel of oil will be discovered if no exploratory drilling is done.

Law of Supply and Demand

In considering the implications of Fig. 6, it is well to remember that at any time discoveries are substantially larger than necessary to satisfy current needs, the urgency for further exploration will naturally diminish. This is nothing but a manifestation of the law of supply and demand which, despite the efforts of the New and Fair Deals to mutilate, degenerate, emaciate, eviscerate, repeal, or ignore it, still demonstrates its validity on the American scene. Since geophysical operations represent the advance guard of the exploration forces, they are the first to encounter changes in climate. However, the full utilization of seismograph surveys is accomplished in a period of years rather than of months and therefore seismograph surveys will continue to contribute to discoveries for some years after they have been completed. Figure 6 reflects all these factors to a remarkable degree.

Fig. 6 shows one more thing worth pondering. The number of seismograph parties operating in the United States at the peak of the forties was more than two times as great as the number at the peak of the thirties. The oil discovered, however, was not twice as great. No doubt the law of diminishing returns had an important influence here. Oil is an exhaustible resource. As the total of oil consumed and added to known reserves is increased, the amount remaining to be discovered is correspondingly decreased. The ease of future discovery is probably directly proportional to the amount which remains to be found. The cost will rise as the remainder falls. This is probably true regardless of the present efficiency and the probable improvement in the techniques employed in exploration. These will undoubtedly considerably ameliorate the rise in costs. It is improbable that they will prevent it.

It is important to note that Fig. 6 covers only operations in the United States, the most heavily prospected area in the world. It is almost certain that the United States has discovered a greater fraction of its ultimate production than any other area of great potential. This needs to be considered in determining how to apportion the exploration dollars between domestic and foreign areas.

United States wells have produced more than half of their all-time output of crude oil during the last 13 years. More than half of the natural gas saved and marketed from them has been produced during the last 11 years. Although these periods included the war years, an inspection of the tabulated annual production data affords no clue as to when the war began, when it ended or, in fact, that there was any war. This indicates the recent pace of the industry and is reasonable evidence of sturdy growth which, save for minor adjustments, may be confidently projected into the future.

Barring a material decrease in the United States standard of living, all social and economic factors indicate a rising trend in the future demand for petroleum products. Since the discoveries of the past 2 years have been exceptionally large, they may not reasonably be expected to set a new pattern. Rising production will inexorably require an increased volume of geophysical surveys. It is probable that the recent peaks of activity will be surpassed in the very near future.

The data and related information which made the preparation of this report possible came from many sources and were gathered with great care. It is a pleasure to acknowledge the assistance of my associates in the committee and the help given me by members of my staff and others in the collection and compilation of the data and in the preparation of this report.

4,000 Exploration Scientists Gather

(Continued from page 108)

reefs. For this crowd knows that reefs are not the exclusive property of Canada or West Texas, but are widespread, and can be the source of oil fields in many other parts of the United States, and in many parts of the world outside the United States.

S.E.G. COMMITTEE MEETINGS

MONDAY

2:00 p.m.—General Business Meeting, President Andrew Gilmour in charge.
5:00 p.m.—Radio Facilities Committee, R. D. Wyckoff, chairman.

TUESDAY

7:00 p.m.—S.E.G. Joint Council Meeting. Incoming and outgoing executive committee and district representatives.

A.A.P.G. COMMITTEE MEETINGS

SUNDAY

10:00 a.m.—Executive committee, C. W. Tomlinson, chairman.
1:00 p.m.—National Responsibility, O. F. Kotick, chairman.
2:00-5:00 p.m.—Applications of Geology, Karl A. Mygdal, chairman. Statistics of Exploratory Drilling, F. H. Lahee, chairman.
7:00-10:00 p.m.—Publication, George C. Grow, chairman.

MONDAY

8:00 a.m.-12 noon—Geologic Names, H. D. Morgan, chairman.
9:00 a.m.-5 p.m.—Business (annual meeting), Edward A. Koester, chairman.
9:00 a.m.-5:00 p.m.—Research, John T. Rouse, chairman.
9:00 a.m.-12:00 noon—Samples and Cores, Dollie Radler Hall, chairman.
9:00-11:00 a.m.—Distinguished Lectures, H. T. Morley, chairman.
2:00-5:00 p.m.—Medal Award, Frank R. Clark, chairman.
4:00-5:00 p.m.—Paleozoic Subcommittee, L. E. Workman, chairman.

TUESDAY

8:00 a.m.—Editors' Conference, Alfred H. Bell, chairman.
8:00 a.m.-12:00 noon—Mesozoic Subcommittee, T. H. Philpott, chairman.
4:00-5:00 p.m.—Cenozoic Subcommittee, G. E. Murray, chairman.

TUESDAY NIGHT

Symposium on Possible Future Oil Provinces of North America

1. Foreword—Max Ball, consultant, Washington, D. C., general chairman.
2. Rocky Mountain region—C. E. Dobbin, chairman, U.S.G.S., Denver.
3. Western Canada—J. S. Irwin, chairman, consultant, Calgary.
4. Alaska—George Gryc, chairman, U.S.G.S., Washington.
5. Pacific Coast and Nevada—G. B. Moody, chairman, Standard Oil Co. of California, San Francisco.
6. West Texas—Ronald DeFord, chairman, University of Texas, Austin.

WEDNESDAY

5:00 p.m.—Incoming Executive Committee, joint meeting, A.A.P.G., S.E.P.M., and S.E.G.

THURSDAY

Symposium on Possible Future Oil Provinces of North America

1. Northern Mid-Continent States—Dollie Radler Hall, chairman, consultant, Tulsa.
2. Fort Worth Basin and Muenster Arch—F. T. Clark, chairman, Cities Service Oil Co., Fort Worth.
3. Mexico—Manuel Alvarez, Jr., chairman, Asociacion Mexicana de Geologos Petroleros, Mexico, D.F.
4. Mesozoic Downdip of South Texas—Paul B. Hinyard, chairman, Shell Oil Co., San Antonio.
5. Tertiary of South Texas—Hershal C. Ferguson, chairman, consultant, Houston.
6. Continental Shelf in Gulf of Mexico—Paul Weaver, chairman, Gulf Oil Corp., Houston.
7. Southeastern States—Tom McGlothlin, chairman, consultant, Laurel, Miss.
8. North Atlantic Coastal Plain—Judson L. Anderson, chairman, Johns Hopkins University, Baltimore.
9. Illinois Basin—David H. Swann, chairman, Illinois Geological Survey, Urbana.
10. Michigan Basin—Rex P. Grant, chairman, Michigan Geological Survey, Lansing.
11. Eastern Canada—J. F. Caley, chairman, Geological Survey of Canada, Ottawa.
12. Eastern United States—R. C. Lafferty, Jr., chairman, consultant, Charleston, W. Va.

BEGINNING SPECIAL WEST TEXAS SECTION

by Charles J. Deegan
Associate Editor

THIRD LARGEST "Oil State"

THE importance of the Permian basin area of West Texas and southeast New Mexico is often underestimated, even by oil men, because the various statistics on the area are usually presented partly as a subdivision of the huge Texas total, and partly under New Mexico.

When it is considered as a single separate area, it is immediately apparent that here in one natural operating geographic unit is the third largest oil-producing state, exceeded only by the remainder of Texas and California. Perhaps even more significant for the long-range future, in proven reserves it ranks second, ahead of California, and exceeded only by the rest of Texas. (See Fig. 1.) Third largest oil producer, second largest proven reserves—that is the Permian basin in a nutshell.

The name Permian basin started out as a geological description. Now,

TABLE 1—PERMIAN BASIN—1949 WILDCAT DRILLING BY COUNTIES

County—	Total No. tests	Total footage	No. oil or gas strikes
Pecos	50	146,535	3
Lea	32	244,407	11
Runnels	29	119,765	16
Scurry	29	206,160	13
Crockett	26	136,393	2
Eddy	24	67,709	3
Schleicher	16	88,125	2
Gaines	15	137,916	3
Tom Green	14	64,135	1
Andrews	12	89,727	1
Mitchell	11	70,592	2
Coke	11	59,696	2
Crane	10	57,446	2
Borden	9	75,491	4
Culberson	9	19,416	0
Reagan	8	62,787	1
Chaves	8	43,689	0
Garza	7	32,779	1
Sterling	6	16,836	2
Upton	6	57,269	3
Midland	5	51,329	2
Sutton	5	25,507	1
Ector	4	23,205	2
Howard	4	28,536	1
Irion	4	28,977	0
Lynn	4	37,835	0
Cochran	3	20,926	2
Concho	3	7,440	0
Dawson	3	27,639	1
Kent	3	17,974	0
Kimble	3	7,695	0
Terry	3	22,695	1
Ward	3	25,553	0
Yoakum	3	20,469	0
Glasscock	2	13,901	0
Hale	2	15,209	0
Hockley	2	13,975	0
Lamb	2	12,307	0
Lubbock	2	15,065	0
McCulloch	2	4,963	0
Motley	2	15,167	0
Reeves	2	8,539	0
Terrell	2	17,984	1
Val Verde	2	4,260	0
Winkler	2	21,599	1
De Baca	2	11,545	0
Dickens	1	8,117	0
Loving	1	3,442	0
Menard	1	3,559	0
Total	409	2,312,235	83

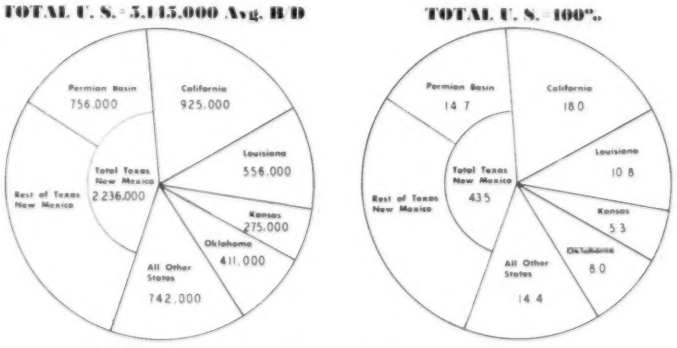

Fig. 1—The Permian basin's relative importance in total U. S. oil picture.

TABLE 3—PERMIAN BASIN PRODUCTION AND RESERVES*

Field and County—	Apr. 1950 allowable bbl. dly. avg.	Year 1949 production bbl. dly. avg.	1-1-50 est. proven reserves (million bbl.)
Levelland-Slaughter (Hockley)	60,062	62,526	487
Scurry Reef (Kent-Scurry-Borden)	50,150	11,414	896
Wasson (Yoakum)	45,447	52,816	452
T-X-L (Ector)	32,562	44,585	187
Fullerton (Andrews)	30,534	27,586	264
Eunice-Monument (Lea)	29,427	29,868	139
Keystone (Winkler)	27,813	30,216	283
Goldsmith (Ector)	25,840	25,044	298
Yates (Pecos)	25,092	32,556	438
McElroy (Crane)	20,096	22,318	141
Howard-Glasscock (Howard-Glass.)	18,140	13,660	71
Drinkard (Lea)	17,275	18,471	38
North Cowden (Ector)	14,937	16,737	143
Dollar Hide (Andrews)	13,767	12,644	66
Foster (Ector)	13,410	16,474	88
Seminole (Gaines)	12,630	15,370	146
Vacuum (Lea)	12,275	12,189	82
McCamey (Upton)	10,747	8,288	48
Andector (Andrews-Ector)	9,387	10,605	52
Sand Hills (Crane)	9,331	10,277	65
South Cowden (Ector)	8,650	7,249	22
Garza (Garza)	8,014	7,055	32
Jordan (Crane-Ector)	7,832	7,181	28
Wheeler (Winkler-Ector)	7,787	8,312	38
Shafter Lake (Andrews)	7,540	9,679	30
Anton-Irish (Lamb-Hale)	6,480	6,929	15
Todd (Crockett)	6,186	8,786	68
North Ward-Estes (Ward)	6,149	7,663	53
Martin (Andrews)	5,808	6,973	54
Subtotal above fields	543,248	543,472	4,724
All other fields	215,752	212,528	1,076
Total Permian basin	759,000	756,000	5,800

*Crude plus condensate.

with pre-Permian producing zones assuming more and more importance, the geological description no longer fits. But by general usage among oil men, Permian basin has become a handy geographic tag to include everything in the Texas Railroad Commission's districts 7-C and 8, plus Lea and Eddy counties in southeast New Mexico. So the name continues to be used and will probably persist for many years to come.

The one, big, overwhelmingly important fact about the Permian basis is that in this area the natural conditions necessary for the accumulation of large quantities of oil were

TABLE 2—PERMIAN BASIN—FIRST 3 MONTHS 1950—WILDCAT DRILLING BY COUNTIES

County—	Total No. tests	Total footage	No. oil or gas strikes
Runnels	18	84,739	4
Scurry	17	129,531	3
Borden	14	118,654	3
Tom Green	13	56,512	1
Lea	12	90,513	5
Gaines	9	59,626	3
Pecos	9	31,170	1
Crockett	7	44,380	1
Garza	5	20,101	1
Upton	5	54,452	1
Coke	5	33,923	0
Mitchell	5	38,392	1
Eddy	5	25,425	1
Ector	4	26,152	2
Kent	4	24,546	1
Midland	4	41,252	3
Sterling	4	20,108	0
Schleicher	4	27,733	0
Irion	3	17,201	0
Terry	3	33,086	1
Andrews	3	18,294	1
Chaves	3	11,671	0
Brewster	2	5,747	0
Crosby	2	5,882	0
Culberson	2	8,278	0
Howard	2	17,798	0
Kimble	2	6,793	0
Reeves	2	8,612	0
Sutton	2	10,818	0
Concho	1	2,000	0
Crane	1	5,501	1
Dawson	1	10,005	0
Glasscock	1	13,600	0
King	1	4,439	0
McCulloch	1	1,605	0
Motley	1	7,882	0
Reagan	1	7,000	0
Terrell	1	2,000	0
Ward	1	8,939	0
Total	180	1,131,358	34

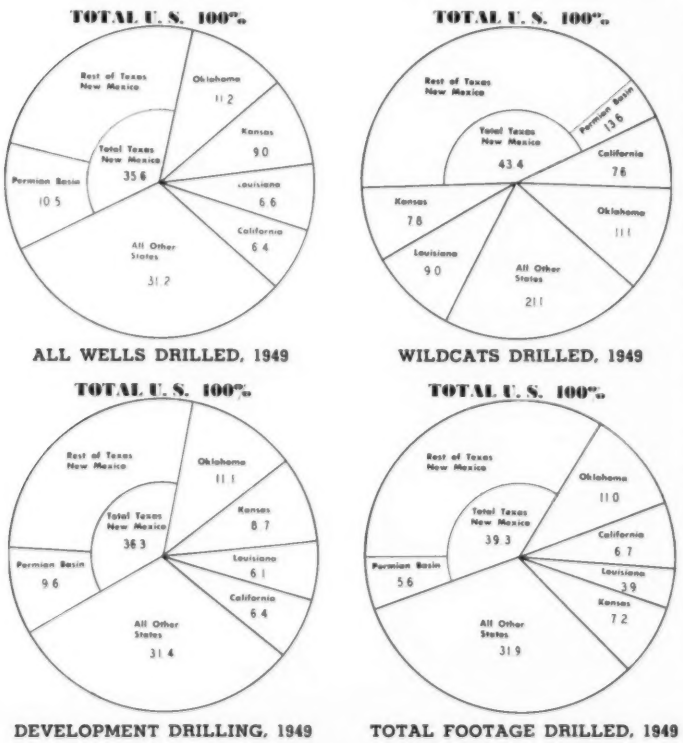

Fig. 2—Permian basin's drilling activity compared to total of U. S.

unusually favorable. We lack a lot of knowing and understanding the whys and wherefores of the origin of oil. We lack a great deal of knowledge about exactly why a lot of oil accumulates in some traps and only a small amount or none at all accumulates in other traps, when both groups of traps look equally favorable.

But all experienced oil men know and recognize the signs when we have found a region where nature has been extremely generous in allowing large pools of oil to accumulate in almost any kind of a reasonably favorable trap. Usually, too, veteran oil men recognize the signs that begin to show up when we have found most of the big oil pools in a region and begin to pick up only the poorer and poorer leavings. Many of these are intangible things, but to a qualified oil man, they are real and important.

By this standard too, the Permian basin grades very high. We continue to find the big ones. In fact, 27 years after the first discovery at Westbrook, Mitchell County, and just 25 years after the first strike at Big Lake, in Reagan County, oil men found the Scurry Canyon reef field. This is already the biggest oil field ever found in the Permian basin, and probably the second largest ever found in the United States. It looks as though only East Texas will out-

TABLE 4—PERMIAN BASIN DEVELOPMENT DRILLING, FIRST QUARTER 1950

Field and county—	No. of wells	No. of oil or gas wells	Total footage drilled (000 ft.)
Scurry Reef (Scurry-Borden-Kent)	272	269	1,864
Levelland-Slaughter (Hockley)	83	81	410
Goldsmith (Ector)	46	45	264
Toborg (Pecos)	42	36	25
Vaughn (Crockett)	39	37	56
Garza (Garza)	27	25	81
Dollar Hide (Andrews)	18	18	152
Sharon Ridge Permian (Crockett)	18	18	32
Langlie-Mattix (Lea)	17	17	59
South Cowden (Ector)	16	16	71
McElroy (Crane-Upton)	14	14	43
Pecos Valley Hi-Gravity (Pecos)	14	13	22
Susan Peak (Tom Green)	14	13	68
Lehn-Apco (Pecos)	13	11	23
Benedum (Upton)	12	10	139
Tunstill (Reeves)	12	10	41
Midland Farms (Andrews)	11	11	52
Drinkard (Lea)	11	11	73
Artesia (Eddy)	10	8	24
Cedar Lake (Gaines)	10	10	48
Fort Chadbourne (Runnels)	10	9	54
T-X-L (Ector)	9	8	62
Cooper-Jal (Lea)	9	9	30
Empire (Eddy)	9	8	5
Abell (Pecos)	8	7	32
Howard-Glasscock (same counties)	8	7	22
Shafter Lake (Andrews)	8	7	84
Wasson (Gaines)	8	8	41
West Seminole (Gaines)	8	6	41
World-Powell (Crockett)	8	8	21
Andector (Andrews-Ector)	7	7	60
Fullerton (Andrews)	7	7	62
Good (Borden)	7	7	57
Jordan (Crane-Ector)	7	7	49
Vealmoor (Howard-Borden)	6	5	47
Subtotal above fields	818	784	4,214
All other fields	281	238	1,385
Total Permian basin	1,099	1,022	5,599

TABLE 5—PERMIAN BASIN DEVELOPMENT DRILLING DURING 1949

Field and county—	No. of wells	No. of oil or gas wells	Total footage drilled (000 ft.)
Levelland-Slaughter (Hockley)	521	513	2,566
Scurry Reef (Scurry-Borden-Kent)	295	293	2,014
Dollar Hide (Andrews)	54	54	499
Shafter Lake (Andrews)	52	49	481
Goldsmith (Ector)	85	85	471
South Cowden (Ector)	84	79	382
T-X-L (Ector)	47	44	313
Benedum (Upton)	25	23	286
Keystone (Winkler)	37	34	224
Midland Farms (Andrews)	42	41	201
Anton-Irish (Lamb-Hale)	34	34	201
Drinkard (Lea)	62	59	406
Langlie-Mattix (Lea)	60	60	207
Toborg (Pecos)	132	122	66
Sharon Ridge Permian (Scurry)	106	103	194
Pecos Valley Hi-Gravity (Pecos)	94	79	149
Garza (Garza)	49	48	152
McElroy (Crane-Upton)	49	48	152
Tunstill (Reeves)	48	41	162
Andector (Andrews-Ector)	21	20	179
Block 31 (Crane)	17	16	160
Jameson (Coke)	26	25	164
Jordan (Crane-Ector)	34	34	252
Susan Peak (Tom Green)	30	30	178
North Cowden (Ector)	29	28	133
West Seminole (Gaines)	28	28	144
Adair (Gaines-Terry)	26	25	125
Fuhrman-Mascho (Andrews)	27	25	123
Sand Hills (Crane)	33	33	125
Smyer (Hockley)	34	34	200
Wasson (Gaines)	24	24	131
Barnhart (Reagan)	12	12	110
Yarborough and Allen (Ector)	10	10	108
Brunson (Lea)	20	20	152
Subtotal above fields	2,247	2,171	11,408
All other fields	1,091	940	5,047
Total Permian basin	3,338	3,111	16,455

rank it as an oil field. Starting in Scurry County, it has spread both southwest into Borden County and north into Kent County. (See Fig. 3.)

Geologically the Permian basin is divided into four main features, with other minor features not so clearly established as yet. The dominant feature for many years was called the Central Basin platform; the Delaware basin lies on the west side of this platform; the Midland Black Shale basin on the east side of this platform; and on the east side of the Midland basin, the Eastern Shelf or Eastern platform.

Although the first oil field was found on the Eastern platform, at Westbrook in 1921; and the first major field in the Midland Black Shale basin, at Big Lake in 1923, the main play and development for many years was largely concentrated along the Central Basin platform.

As of today, the biggest development has been along the Central

(Continued on page 179)

TABLE 6—PERMIAN BASIN MAJOR OIL FIELDS*—STATUS AS OF JANUARY 1, 1950
(In thousands of barrels)

Name of field—	Year of first discovery	Estimated ultimate production	Remaining reserves 1-1-50	Cumulative prod. to 1-1-50	Production 1949	Production 1948	Geologic Age of main production
Scurry Reef	1948	900,000	895,828	4,172	4,166	6	Penna. lime reef
Yates	1926	800,000	438,243	361,757	11,883	18,150	Permian lime
Levelland-Slaughter	1936	650,000	486,870	163,130	22,822	27,371	Permian lime
Wasson	1936	650,000	452,437	197,563	19,278	28,882	Permian lime
Goldsmith	1934	400,000	297,651	102,349	9,141	11,160	Permian lime
Keystone	1930	360,000	283,436	76,564	11,029	14,559	Ordovician-Permian
McElroy	1926	335,000	141,310	193,690	8,146	10,617	Permian lime
Fullerton	1942	325,000	264,198	60,802	10,069	15,918	Ord.-Dev.-Permian
T-X-L	1944	250,000	186,606	63,394	16,474	23,934	Ord.-Sil.-Dev.-Permian
Hendrick	1926	230,000	15,199	214,801	1,300	1,226	Permian lime
North Cowden	1930	225,000	143,410	81,590	6,109	8,947	Permian lime
Howard-Glasscock	1926	210,000	70,533	139,467	4,986	5,545	Permian lime
Seminole	1937	200,000	146,315	53,685	5,610	8,113	Permian lime
Monument	1934	185,000	84,655	100,345	6,488	6,902	Permian lime
Hobbs	1928	175,000	47,665	127,335	3,732	3,844	Permian lime
Eunice	1928	150,000	54,347	95,653	4,414	4,770	Permian lime
Foster	1932	145,000	87,827	57,173	6,013	8,105	Permian lime
Vacuum	1929	130,000	81,871	48,129	4,449	4,508	Permian lime
McCamey	1925	125,000	47,611	77,389	3,025	3,417	Permian lime
Big Lake	1923	125,000	15,055	109,945	1,032	1,110	Ordovician-Permian
Ward, North-Estes	1929	120,000	52,777	67,223	2,797	3,876	Permian lime
Total 21 major fields		6,690,000	4,293,844	2,396,156	162,963	210,960	
Other Permian basin fields		2,363,000	1,506,156	856,844	112,485	110,564	
Total whole Permian basin		9,053,000	5,800,000	3,253,000	275,448	321,524	
Total Texas-New Mexico		28,912,000	15,253,000	13,659,000	815,036	970,864	
Total United States		64,999,000	25,909,000	39,090,000	1,878,304	2,051,433	

*Fields with ultimate production of 100 million barrels or more.

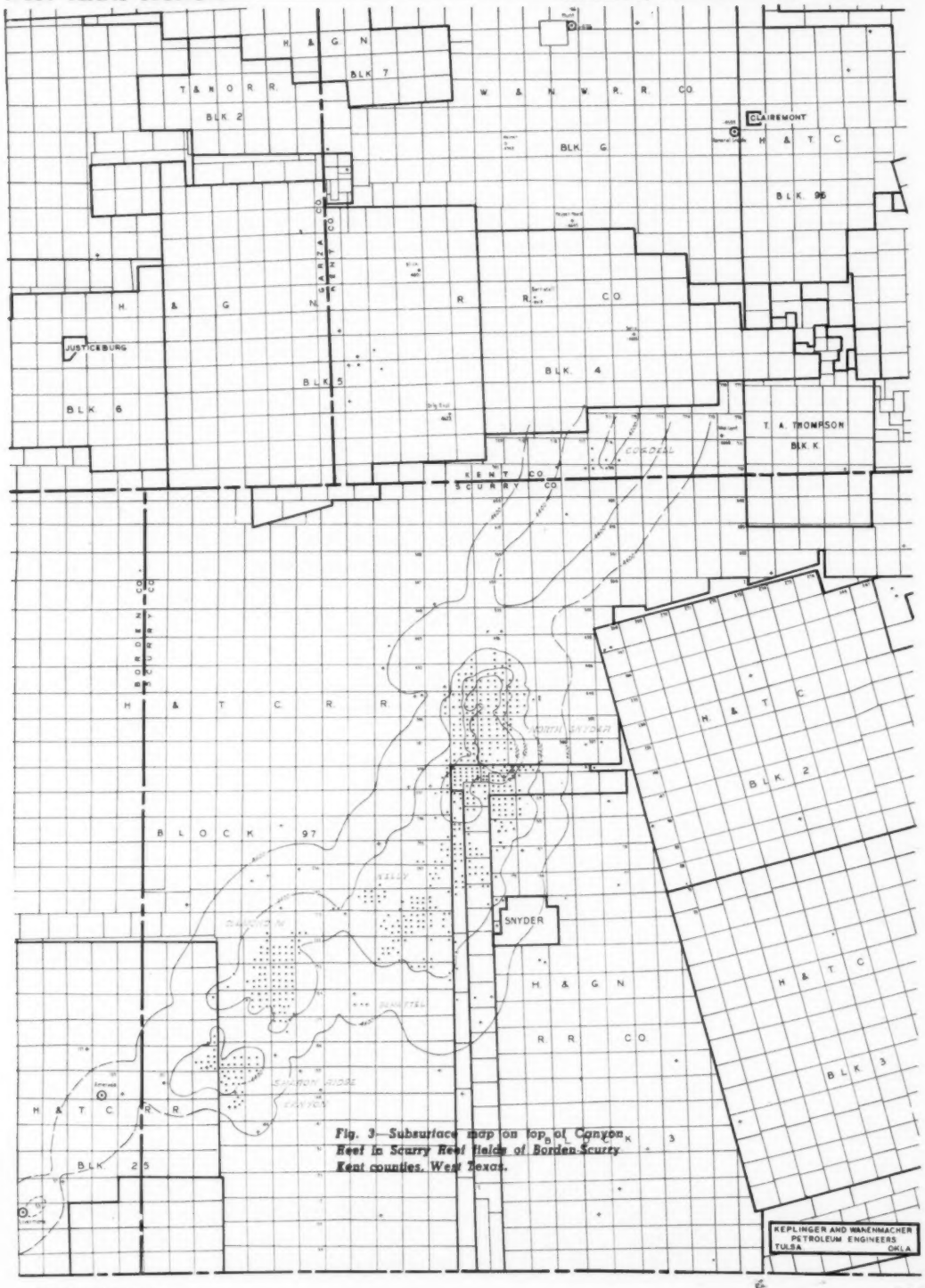

Fig. 3—Subsurface map on top of Canyon Reef in Scurry Reef fields of Borden-Scurry-Kent counties, West Texas.

West Texas Oil-1950

The Permian basin is one of the world's most important areas. This article tells how it got started — how it grew — and where it's going.

by James C. Watson

MANY times in the past, West Texas has been written off as being finished so far as the region ever developing any new and important sources of petroleum production is concerned. Each time such predictions have been made, West Texas has bounced back stronger than ever, and developing larger each time.

After developing its first commercial oil production at Westbrook in 1921, and its first major oil field at Big Lake in 1923, oil-exploration activity in West Texas developed at a fairly steady rate until the 1929 financial crash, the resultant depression, and the discovery and development of East Texas oil field.

The author, Jas. C. (Jim) Watson, is owner and operator of the Permian Basin Oil News Service, in addition to his position as oil editor of the Midland Reporter - Telegram. Just prior to organizing his present service, he served 4 years as executive secretary of the West Central Texas Oil and Gas Association at Abilene. His entire business life has been devoted to news and oil, and all in West Texas.

The depression caused a universal drop in all types of business, and East Texas oil field, with its many advantages, caused most oil companies and independent oil operators to forget about attempting to find new oil reserves in West Texas. Then along came the Illinois "boom" of the middle 1930's to claim the spotlight. While the exploratory and development activity was going on in the East Texas and in Illinois regions, West Texas oil operations declined to extremely low points.

Annual Production Figures

A good example of what happened to West Texas oil between the time

West Midland, West Texas Oil Headquarters

A FAIRLY good way to visualize what is in store for West Texas oil in the future is to check on what has happened to Midland, the headquarters city for oil operations in West Texas, during recent years.

Population of the city in 1940 was less than 10,000 persons. As of April 1, 1950, it is estimated that Midland had at least 30,000 citizens.

More than 125 new oil offices have been opened in Midland during the last 8 years. Practically all of the more than 200 oil companies and oil operators who were located in Midland prior to 1942 have increased the size of their organizations and have greatly increased the size of their office quarters. There are now more than 325 oil offices in Midland.

Currently Midland has 378,070 sq. ft. of modern office space in use. Of that enormous amount of space 248,870 sq. ft. of it has been erected and occupied during the past 5 years. Practically all of that new office space is occupied by oil offices.

There is now a big demand for more office space in Midland by oil companies and oil operators, or by concerns connected with the oil industry in some phase.

Plans are in the making for the erection, in the near future, of more office space in Midland. There is a good possibility that at least 75,000 more square feet of space will be provided in a new modern office building within the next 12 months. One major company which erected its own building in Midland about 4 years ago is preparing to more than double the size of that structure. Most of the new office space which has been erected in Midland in recent years was leased on 10 and 15-year contracts before construction was ever started—and most of those leases were from major oil companies.

TIDE WATER ASSOCIATED OIL CO.'S

RECORD-MAKING WELL

Over 12,000 p.s.i. bottom-hole pressure was encountered in bringing in a 13,000 ft. well for Tide Water Associated Oil Co. near New Orleans. This record-breaking well required tubing with corrosion resistance as well as exceptional strength.

Over 12,000 ft. of 2⅜ inch B&W NICLOY 9 OIL WELL TUBING helped to put this well on production.

B&W NICLOY 9 TUBING is only one of the many B&W developments in tubing that has contributed materially to progress in petroleum production and processing. Helping the Petroleum Industry to solve tough tubing problems is an old story with B&W. Perhaps it will pay you, as it has many other companies, to call upon the experience of B&W to help solve your carbon, alloy or stainless steel tubing problems.

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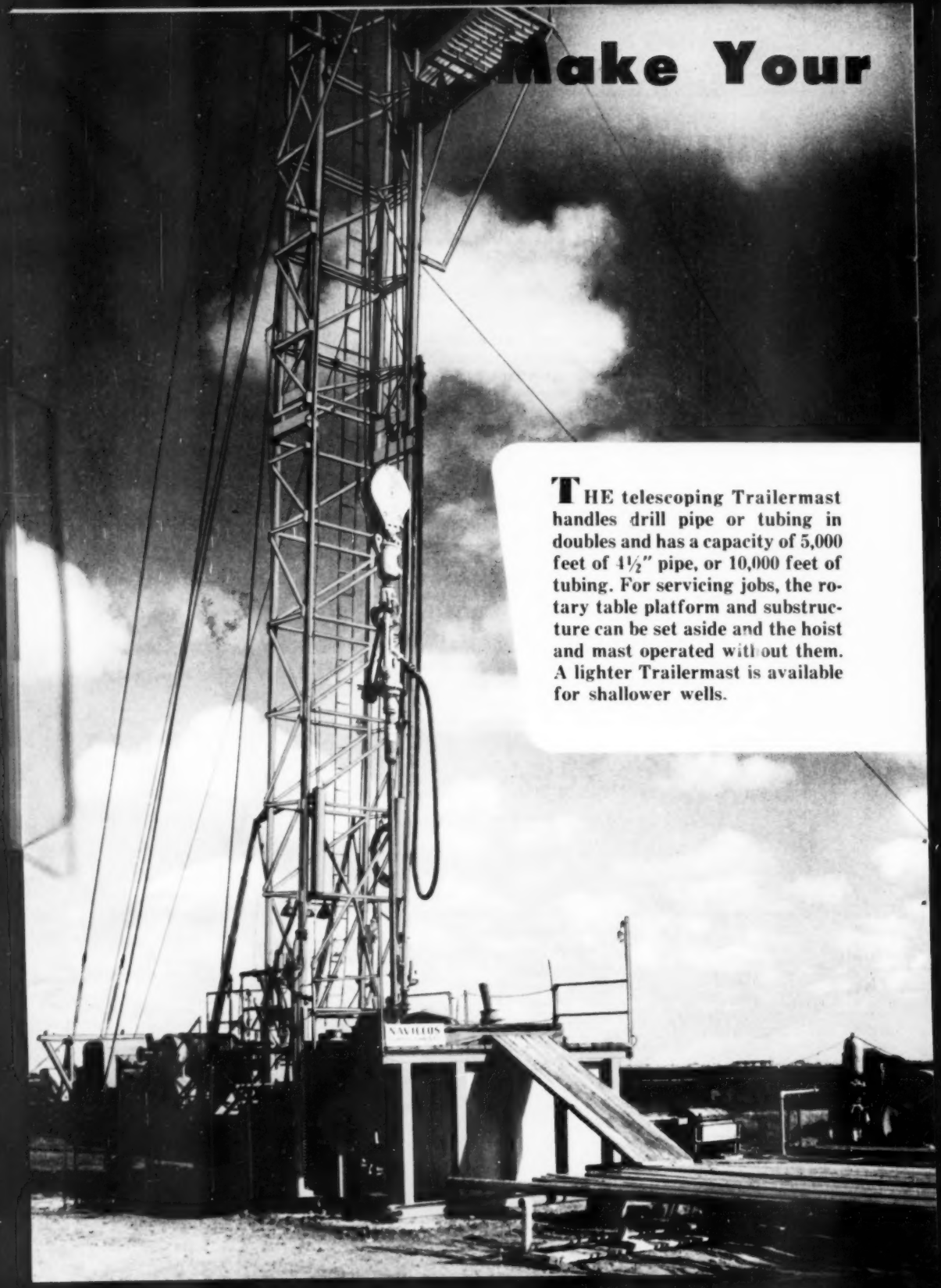
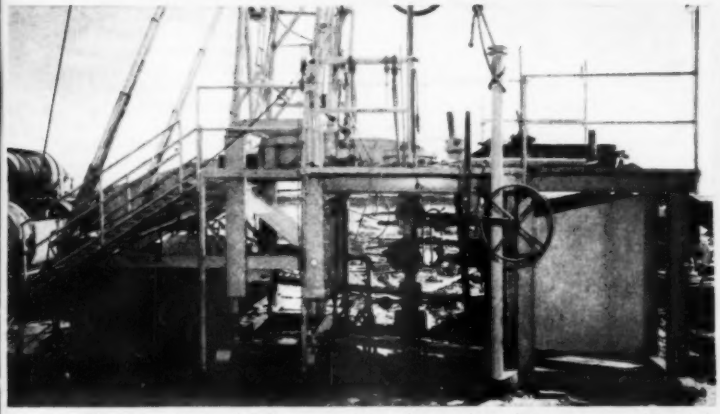


THE telescoping Trailermast handles drill pipe or tubing in doubles and has a capacity of 5,000 feet of 4½" pipe, or 10,000 feet of tubing. For servicing jobs, the rotary table platform and substructure can be set aside and the hoist and mast operated without them. A lighter Trailermast is available for shallower wells.

Old Drilling Rig
UP-TO-DATE
with the *NEW* "CARDWELL" Trailermast

COMPETITION getting tougher? Put your draw works or hoist on this new Trailermast and cut your moving and rig-up expense in half. Your single-engine rig combined with this lightweight, telescoping mast on a trailer makes an up-to-date outfit that gives economy plus real satisfaction.

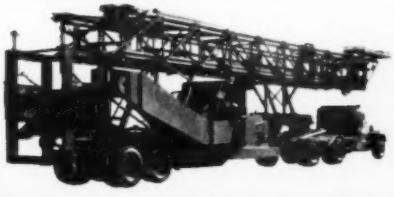


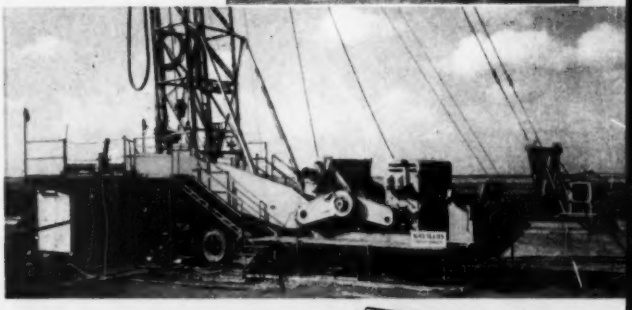
The 16' x 16' derrick floor provides plenty of working space and is high enough for blowout preventers and wellhead connections. Note optional location of doghouse.

Mast is erected with built-in hydraulic system and raised to full height with traveling block and drilling line. The rig is usually ready for work in less than three hours.

Any "Cardwell" single engine rig is mounted on the Trailermast frame and can be removed for operation under conventional derrick. Note convenient walkways and built-in rathole digger.

Trailermast with draw works in place is quickly moved with a three- to five-ton truck tractor.





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"Cardwell's" reputation in all fields for building "Tough Iron" comes from the use of Alloy steels and heat-treatment. This "know how" cannot be copied.

of the discovery of Westbrook field and the time the region's operations started upward again in 1943, is shown by the changes in annual production figures for several representative years.

In 1924, for the first time, West Texas produced more than 1,000,000 bbl. of crude oil, with a total of 1,348,229 bbl. Production continued upward until it reached 123,672,000 bbl. of oil during 1929, just 5 years later.

That 5-year period covered the discovery and development of such major oil fields as Howard-Glasscock and Iatan-East Howard in Howard and Glasscock counties; Crane-Cowden and McElroy in Crane and Upton counties; Todd in Crockett; Penwell in Ector; Yates in Pecos and Crockett; McCamey in Crane and Upton; Hendrick, Kermit, and Scarborough in Winkler; Grandfalls and Shipley in Ward; and North Ward-Estes in Ward and Winkler counties.

Following the 1929 record high, production declined steadily until 1934, when it reached a low of 48,126,000 bbl. Production then started upward again and in 1941, the year the United States entered World War II, West Texas produced 117,570,000 bbl. of crude oil.

The next year, 1942, West Texas production dropped to 81,030,000 bbl. because of war conditions. In 1943 it increased to 98,070,000 bbl., and it has been increasing steadily ever since.

During 1949 West Texas oil production rose to 288,146,000 bbl., to give the region a cumulative production of 2,630,893,000 bbl. since the first oil discovery in the region in 1921.

At the end of 1949, West Texas known, proven reserves of oil were estimated to be 5,238,000,000 bbl. That was a net increase of 2,673,168,000 bbl. over 1941, a gain in reserves of more than 100 per cent in 8 years. During that period West Texas produced a total of 1,388,393,934 bbl. of oil. So in 8 years, oil men found 4,061,562,000 bbl. of new oil reserves in this region.

It can readily be seen from those figures that something has happened to West Texas oil between the low points of 1942 and 1943 and the start of 1950.

To illustrate further, the fact that something has happened, and is happening, to West Texas oil:

In 1943 only 902 wells were drilled in West Texas. During 1949, 3,261 wells were drilled in West Texas. Of those, 2,788 were finished as oil producers, 24 were gas producers, and 449 were dry holes.

Included in the 3,261 wells drilled in West Texas last year were 343 wildcats. A total of 70 new discoveries resulted from the drilling of those 343 wildcats. Of those successful explorations 63 were finished as discoveries of new oil fields or new oil pays, and 6 were completed as the openers of gas-producing areas.

Forecast for 1950

The forecast for 1950 revealed that 4,070 new wells are planned for drilling in West Texas during the current year. Slated total depth of those explorations aggregates 21,150,000 ft. That will be an increase of 809 wells and 4,752,000 ft. of hole over the 1949 figures.

A total of 561 of the 4,070 wells planned for West Texas in 1950 are due to be wildcats. That will be 221 more wildcats than were completed in the region last year. The other 3,506 are scheduled to be field wells—an increase of 588 over the number of field wells completed in the region in 1949.

West Texas oil development can be divided roughly in two periods. The first period is from the discovery of

(Continued on page 185)

And Odessa, West Texas Oil-Equipment Center

WHEN the first Ector County oil well came in in 1928, Odessa* Tex., was a small frontier cow town with a population of less than 4,000 people.

In 1950, with an estimated population of more than 50,000, Odessa is the oil-equipment center of the Permian basin, serving 25,000 producing wells.

Ector County last year had 3,817 producing wells with a daily allowable of 193,744 bbl., compared to the 1935 figures of 171 wells with 9,883-bbl. allowable. Ector County is the second-ranking county in Texas for production.

Odessa has more than 200 oil-well supply houses making it the home of the largest domestic oil-field supply base, oil-field equipment, servicing, and specialty center in Texas. Volume of oil business for 1948 was $91,000,000 which did not include the sale of pipe estimated at $168,000,000.

Plans for the Permian Basin Oil Show are well under way at Odessa now. The show will be held here October 19-22 inclusive for the first time since 1941, when the show was known as the Little International Oil Show.

*In 1886 a group of Russian-German colonists ran a special train from St. Louis to this point, and opened up a townsite, calling it Odessa, after Odessa, Russia, because it was believed that the "staked plains" would prove to be a great wheat country, such as the territory adjacent to the Russian city of that name. The townsite was literally in the midst of a vast, grassy plains country, with not a single fence between Amarillo and the Mexican border, and no surface water between Stanton and the Pecos River, water used in building the railroad being hauled from the latter place.

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We don't know whether Cementrol* was made for Snyder or whether Snyder was made for Cementrol, but whatever the case, this fully patented pack-off float shoe has done a great job of protecting the Canyon Reef pay zone from cement contamination.

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1920
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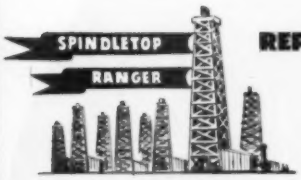
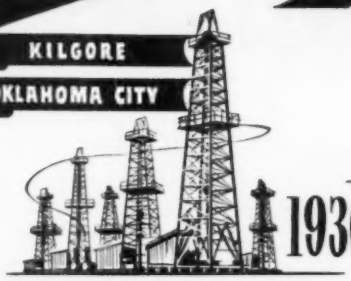


1910
REPUBLIC WAS there



1930
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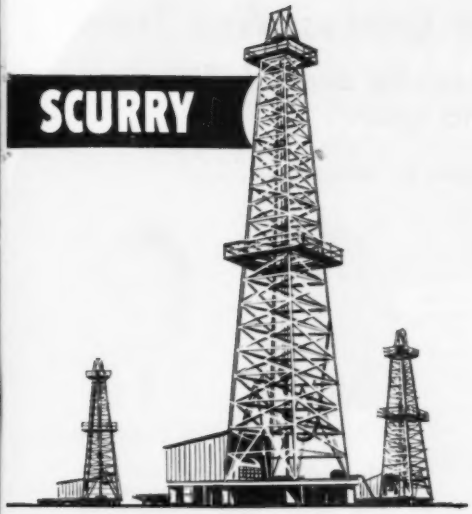
REPUBLIC IS

40 years of service to the Oil Industry
Today . . . . . from 54 Points



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in 1960

REPUBLIC WILL BE there!

1940

STILL there

1950

40th Anniversary

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Pegasus and Meadows Fields

Midland and Upton Counties, West Texas

. . . site of most intensive deep drilling programs in Midland basin

by Frederick Shepherd and Malcolm E. Wilson, Jr.

SINCE the discovery of deep Ordovician limestone production in Big Lake field, Reagan County, Texas, in 1928, exploration for Ellenburger oil has been almost ceaseless and rewarded by the discovery of many major fields in the Midland basin. Depth records have been shattered, indicated reserves have expanded beyond expectation, and drilling activity has mounted to the point where the development investment is enormous. Major oil companies and independents have shared the exploration risk and have participated in the credit for thus preserving a strong domestic position in the supply of petroleum resources.

When Magnolia Petroleum Co. spudded its 1-A T. X. L. wildcat in southwestern Midland County, April 5, 1948, the nearest Ellenburger production was 19 miles southwest in University Waddell field, Crane County, where the pay was encountered between 10,600 and 10,850 ft. Twenty-four miles west, in Ector County, Ellenburger was producing in Jordan field from a depth of 8,650 to 9,000 ft. and the deepest production was from the same formation in Benedum field, Upton and Reagan counties, 27 miles southeast, from 11,000 to 11,500 ft. (See Fig. 1.)

Forty-nine weeks after spudding, this well became the discovery of Pegasus field, with initial Ellenburger production of 975 bbl. per day through a ½-in. choke. Later recompletion of the Magnolia well yielded a potential test of 1,167 bbl. per day through a

G. F. SHEPHERD

M. E. WILSON, JR.

G. Frederick Shepherd has been chief geologist, General American Oil Co. of Texas, Dallas, since 1948. He graduated from Hamilton College, Clinton, N. Y., in geology, did postgraduate geological work at Northwestern University, 1930-1931, and at University of Chicago, 1932-1935. He was geologist with Phillips Petroleum Co., 1936-1940, and geologist with Lane-Wells Co., Houston, 1940-1941. Shepherd then was geologist with William Helis at New Orleans, 1941-1946, and consulting geologist at New Orleans, 1946-1948. He is a member of A.A.P.G., A.I.M.E., A.A.A.S., and other geological societies.

Malcolm E. Wilson, Jr., has been geologist, General American Oil Co. of Texas, since 1948. He graduated from Southern Methodist University, 1947, and did postgraduate work, same, 1948. He was in service July 1943 to June 1946.

Fig. 1—This map of portion of Midland basin shows location of Pegasus and Meadows fields (enclosed in dotted oval) and nearby deep Ellenburger fields (designated by rig symbols).

UNIT RIG'S U-15

THE LEADER IN SNYDER FIELD . . .

A recent survey shows that of all rigs running in the Snyder Field, OVER ONE-THIRD are U-15's. The U-15, famous for fast-drilling, dependability, and economy, continues to be the BIG LEADER in popularity where wells are drilled to 7500 feet. Wherever oil is found, drillers know they can't beat the hard-working U-15. Write for complete information.

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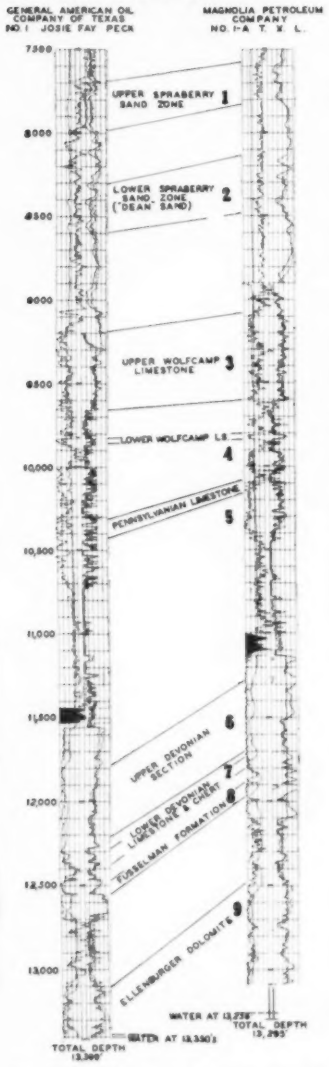

Fig. 2—Multiple pay horizons, Pegasus and Meadows fields, as logged in discovery wells (logs courtesy West Texas Electrical Log Service). In figure, data for all known shows of oil and gas and indications of commercial production are as follows: (1) Gas-cut mud, show of oil; (2) gas-cut mud, show of oil; (3) good oil and gas shows, gas and distillate recoveries, blew out in two wells; (4) good oil and gas shows, gas and distillate recoveries, blew out in one well; (5) flows on drill-stem test approximately 20 bbl. per hour; (6) gas and oil shows, gas and distillate-cut mud on tests; (7) flows on drill-stem tests 25-35 bbl. per hour; (8) porous and saturated limestone, heavily gas and oil-cut mud on tests, small amounts of free oil; (9) drill-stem tests flow 35-50 bbl. per hour (seven wells completed to April 8, 1950).

$\frac{3}{4}$-in. choke with gas-oil ratio 1,403:1. The gravity of the oil was 53.3° and tubing pressure 1,000-300 psi. This well was completed through perforations in 7-in. casing from 12,700-60 and 12,780-12,820 ft.

One offset well had been completed in Pegasus field when General American Oil Co. of Texas spudded its 1 Josie Fay Peck, September 5, 1949, approximately 4 miles west of the Pegasus field discovery well. Six months later this well was completed for another Ellenburger field discovery, Meadows field, later named Sweetie Peck field. The initial potential of this well was 1,056 bbl. per day through a 1-in. choke, producing 53.1°-gravity oil with gas-oil-ratio 922:1. Casing pressure was 450 psi. and tubing pressure 175 psi. Five-and-one-half inch casing was perforated from 13,128 to 13,250 ft. after plugging back from a total depth of 13,399 ft. to 13,311 ft.

Completed February 1, 1949, The Texas Co. 1 Scharbauer, Section 20, Block 40, T-2-S, T&P Survey, 1 mile south of Warfield in Midland County, established a new record for deep production in Texas. This well was perforated in the Ellenburger from 13,050 to 13,230 ft. and was completed as a small well. This record remained unchallenged until the completion of the General American Oil Co. of Texas 1 Josie Fay Peck, March 4, 1950. Ellenburger perforations 13,128 to 13,250 ft. set a new deep production record for Texas.

These two separate fields, Pegasus and Meadows, have been significant in many ways, have much in common, and are now the sites of the most intense deep drilling programs in Texas. The discovery of Pegasus field was the successful result of over 5 years of geological and geophysical cooperative effort. In 1943 the geological department of Magnolia Petroleum Co. worked out the suggestion of a surface structure in this area, based on a topographic expression in the Caliche and supplemented by a few gully-cut exposures in the Edwards limestone. This investigation was combined with a subsurface analysis of the scant mid-Permian wells that had been drilled in the area. Magnolia then leased the acreage to conduct further exploration for a structure.

A series of core holes were drilled to the Yates formation at a depth of approximately 2,650 ft. This core drilling substantiated the presence of a shallow structure previously indicated by surface and subsurface geology. In 1945, the American Republics Corp. 1-A test was drilled to a depth of 8,506 ft., penetrating deep in the Leonard series of the Permian,

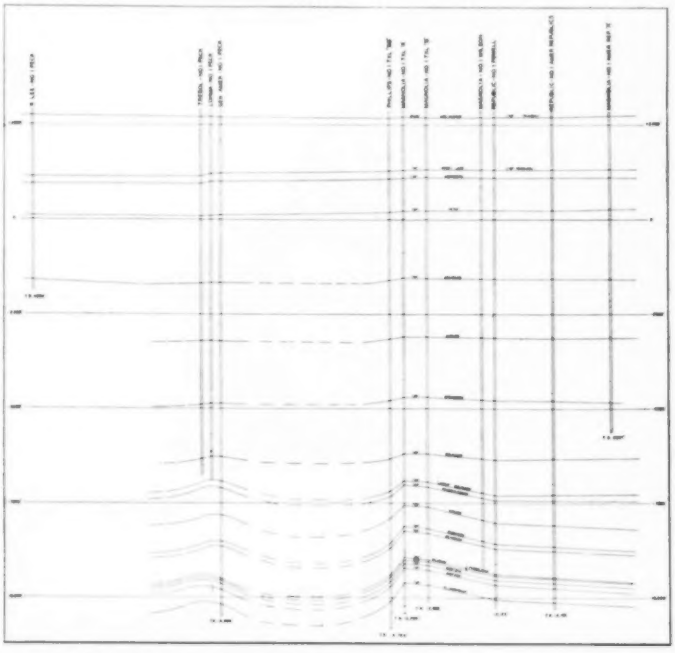

Fig. 3—West-east stratigraphic and structural section of Meadows and Pegasus fields. Vertical exaggeration 5:1. Correlation of important markers shown for convenient reference. Location of section is shown in Fig. 4.

COWETA JUN 29 5PM 1907 IND. T.

ATOKA JUN 24 8PM 1907 IND. T.

COALGATE JUL 12 12M 1907 IND. T

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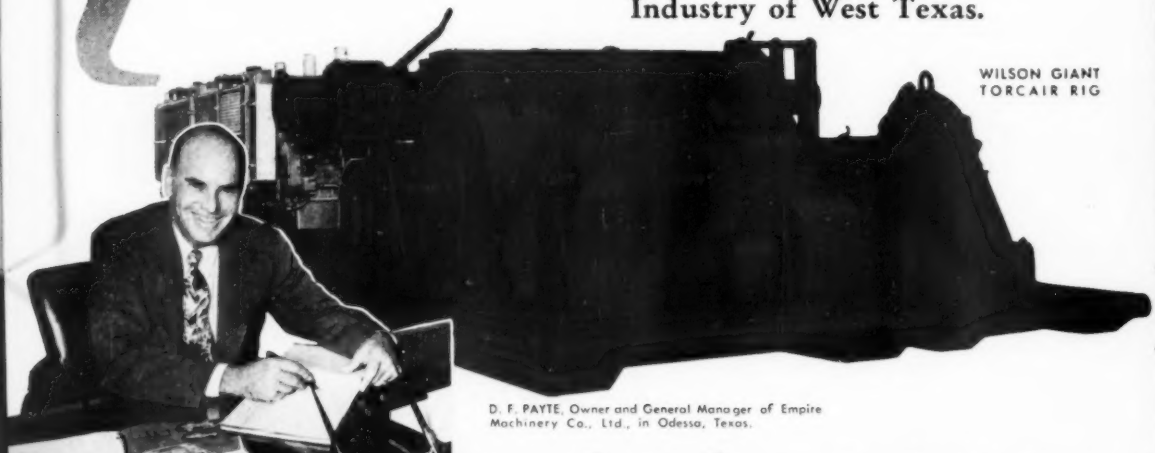

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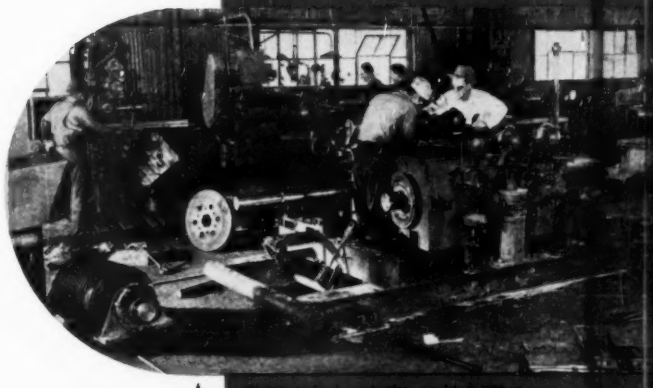

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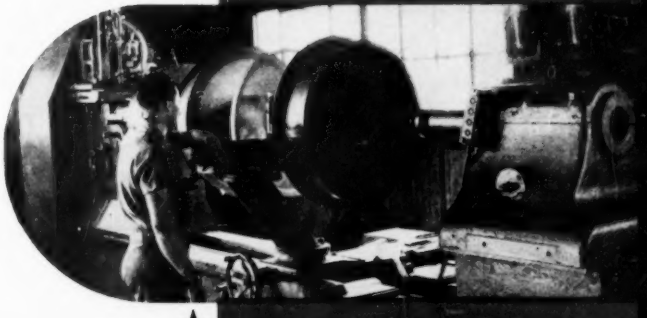

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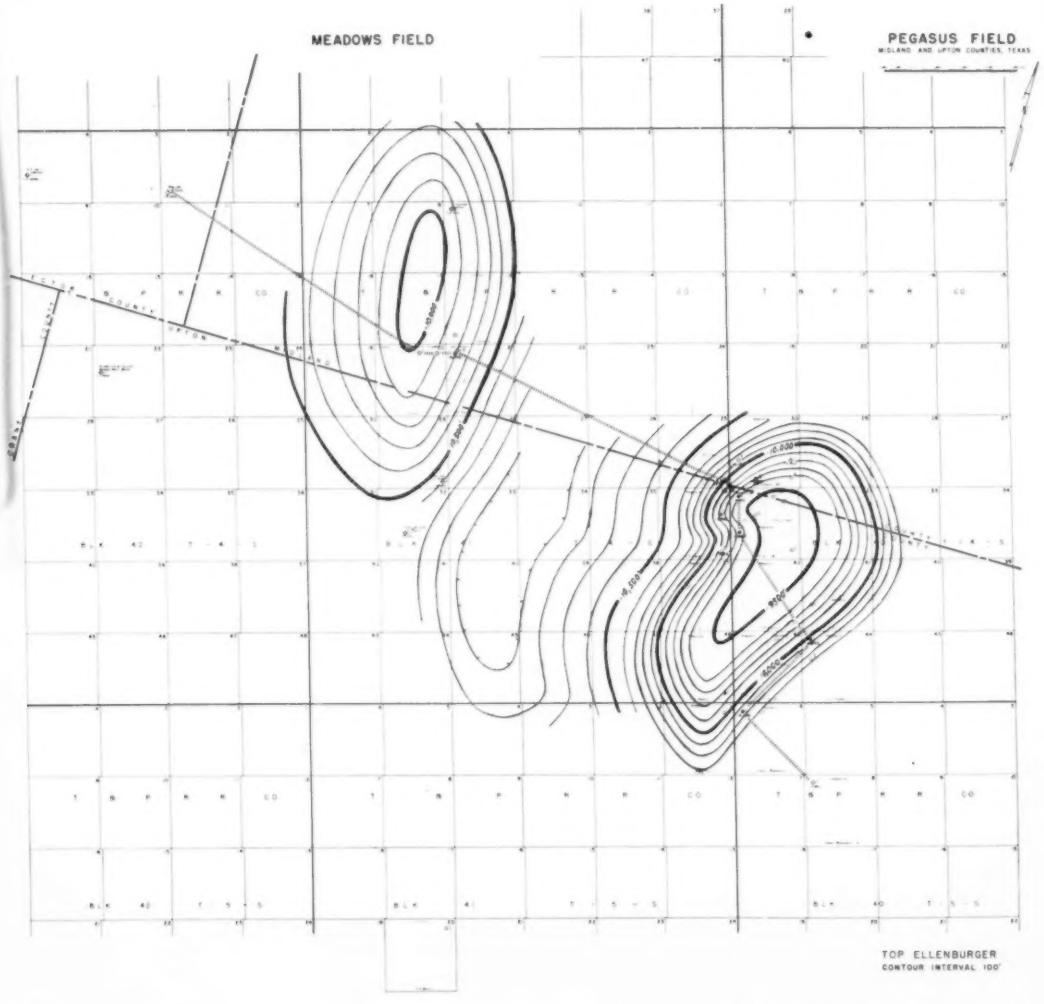
through the upper and lower Spraberry sand zones, but failed by 700 ft. to reach the top of the Wolfcamp formation. Magnolia's 1-30 Roy Glass was next drilled, in 1947, to a total depth of 5,568 ft. in the San Andres formation. The drilling of these exploratory wells confirmed the core-drilled structure and led Magnolia to conduct a detailed reflection seismograph survey in 1947-1948. This program confirmed and delineated the structure and determined the location for the first deep exploratory well, its 1-A T. X. L., the discovery of Pegasus field, indeed a compliment to geological and geophysical cooperation.

A few shallow mid-Permian dry holes had been drilled near the present Meadows field discovery well, but no deep tests had been drilled in this area. In 1944 General American leased the Peck Ranch as an exploration block. The acreage was prospected in 1947-1948 by reflection seismograph by a major oil company with an option to drill a Devonian test. The company was unable to secure permits to shoot adjoining acreage and obtained the reflection of only part of a structure and turned down the option. In 1949 part of the Peck ranch was farmed out to Hall and Stewart Drilling Co. to drill a Pennsylvanian test. After encountering Permian and Pennsylvanian shows, the well was carried to the Ellenburger and became the discovery of a new field.

The major operators of Pegasus field are Magnolia, Republic Natural Gas Co., Phillips Petroleum Co., and Sharpless Oil Corp. In Meadows field the major operators are General American and Sinclair Oil & Gas Co. Both fields are being drilled on a 40-acre spacing pattern although the

Fig. 4—Structural map contoured on top of Ellenburger formation. Interpretation of Pegasus field structure based on subsurface control indicated. Interpretation of Meadows field and its relation structurally to Pegasus field is based on geophysical data and subsurface interpretation of the authors, subject to correction by data to be obtained from future wells drilled.



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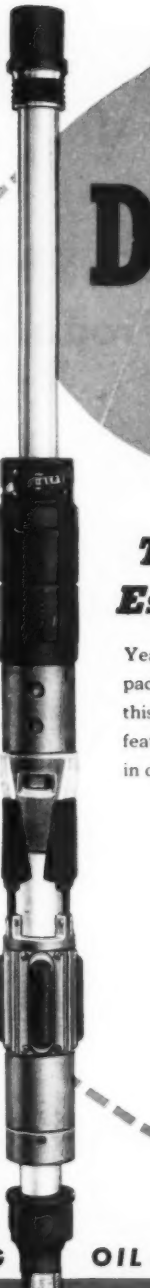

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TABLE 1—CORRELATION CHART OF WELLS IN PEGASUS AND MEADOWS FIELDS, MIDLAND AND UPTON COUNTIES, TEXAS*

	Pegasus field									Meadows field		
Datum tops (ft.) —	Magnolia 1-A TXL	Phillips 1-BB TXL	Magnolia 1-30 Glass	Magnolia 2-30 Glass	Magnolia 1-36 Glass	Magnolia 1-B TXL	Republic 1 Powell	Republic 1 Amer. Rep.	Magnolia 1-A Amer. Rep.	Gen. Amer. 1 Peck	Lohman 1 Peck	Trebol 1 Peck
Elevation	2,891	2,889	2,885	2,893	2,885	2,882	2,868	2,861	2,850	2,902	2,900	2,902
Triassic	+2,712	+2,692		+2,684	+2,723	+2,691	+2,703	+2,698	+2,735	+2,705	+2,715	+2,715
Permian	+1,313	+1,292	+1,301	+1,341	+1,316	+1,330	+1,311	+1,315	+1,322	+1,230	+1,210	+1,157
Anhydrite	+1,101	+1,081	+1,090	+1,123	+1,104	+1,114	+1,099	+1,110	+1,110	+1,011	+1,005	+ 955
Yates	+ 233	+ 199	+ 223	+ 255	+ 232	+ 235	+ 248	+ 238	+ 266	+ 120	+ 100	+ 94
Grayburg	—1,547	—1,605	—1,530	—1,537	—1,549	—1,561	—1,573	—1,576	—1,585	—1,671	—1,679	—1,695
Spraberry	—4,701	—4,791		—4,711	—4,723	—4,699	—4,787	—4,790	—4,830	—4,866		—4,901
Wolfcamp	—6,199	—6,337		—6,217	—6,217	—6,203	—6,355	—6,339		—6,288		—6,345
Lower Wolfcamp	—6,919	—7,194		—6,936	—6,978	—6,946	—7,299	—7,288		—6,928		
Pennsylvanian	—7,019	—7,329		—7,035	—7,094	—7,077	—7,433	—7,437		—7,106		
Strawn	—7,559	—7,896		—7,610	—7,649	—7,599	—8,025	—8,090		—7,828		
Woodford	—8,111	—8,560		—8,191	—8,218	—8,177	—8,578	—8,656		—8,521		
Devonian	—8,239	—8,683		—8,317	—8,353	—8,297	—8,704	—8,777		—8,650		
Silurian	—8,940	—9,389		—9,008	—9,070	—8,999	—9,375	—9,476		—9,510		
Fusselman	—9,001	—9,461		—9,055	—9,153	—9,048	—9,422	—9,508		—9,562		
Montoya	—9,098	—9,569		—9,159	—9,258	—9,146	—9,530	—9,627		—9,648		
Simpson	—9,217	—9,691		—9,291	—9,377	—9,275	—9,660	—9,757		—9,802		
Ellenburger	—9,602	—10,093		—9,685	—9,768	—9,667	—10,052	—10,126		—10,196		
Total depth	—10,404	—10,814	—2,684	—9,979	—10,050	—10,113	—10,257	—10,299	—5,656	—10,497		
Thickness data—												
Triassic	1,399	1,400		1,343	1,407	1,361	1,392	1,383	1,413	1,475	1,505	1,558
Permian	8,332	8,621		8,376	8,410	8,407	8,744	8,752		8,336		
Permian - Spraberry	6,014	6,083		6,052	6,039	6,029	6,098	6,105	6,152	6,096		6,058
Spraberry-Pennsylvanian	2,318	2,538		2,324	2,371	2,378	2,646	2,647		2,240		
Pennsylvanian	1,092	1,231		1,156	1,124	1,100	1,145	1,219		1,415		
Mississippian	128	123		126	135	120	126	121		129		
Devonian	701	706		691	717	702	671	699		860		
Silurian	158	180		151	188	147	155	151		138		
Montoya & Simpson	504	524		526	510	521	522	499		548		

*For purposes of structural correlation, datum tops have been selected at or near the formation tops indicated. Differences of opinion exist in the selection of formation tops by sample examination and electrical log interpretation. All tops in this table are based on correlative points on electrical or radioactivity logs. (Logs used in preparation of this table, courtesy West Texas Electrical Log Service).

north end of Pegasus field has thus far been drilled with one well to 80 acres. Only the Ellenburger formation is being developed presently at Pegasus while Meadows field is being developed in the Ellenburger, Devonian, and Pennsylvanian formations simultaneously.

At the time of this writing (April 8, 1950) there are 6 completed wells in Pegasus field, 13 are drilling, and 2 locations are being prepared for drilling. In Meadows field, one well is completed, two Ellenburger tests are drilling, one Devonian and one Pennsylvanian well are drilling, and three locations have been staked for Ellenburger tests.

Multiple-Pay Fields

Shows of oil and gas or indications of commercial production have been found in four Permian and five pre-Permian zones in Pegasus and Meadows fields. Fig. 2 is a reproduction of the electrical logs of the discovery wells with the position of all shows encountered to date. In the following discussion of these pays all depths are referred to in respect to the General American 1 Peck well.

The shallowest show was encountered in the upper Spraberry sand zone, 7,770-7,980 ft. Some wells lost returns in this zone when drilling with clear water and drill-stem tests recovered gas-cut mud with a rainbow show of oil. Similar conditions were encountered in the lower Spraberry sand zone ("Dean" sand) at intervals from 8,305 to 8,590 ft. The age of these zones is Leonard and probably correlates with the producing zones of the Spraberry field in Dawson County, and Tex-Harvey field, Midland County.

The upper Wolfcamp limestone between 9,190 and 9,660 ft. has several zones which have been drill-stem tested in various wells of Pegasus and Meadows fields. On these tests, gas comes to the surface and recoveries of gas and heavily oil-cut mud with a small amount of free oil are obtained.

The lower Wolfcamp limestone, 9,830-72 ft., blew out in the Magnolia 1-B T. X. L. after which drill-stem tests recovered a large amount of gas with some distillate rising to the surface and heavily gas and distillate-cut mud and a small amount of free distillate were recovered in the tool. Good oil and gas shows have been found in the samples of other wells in this zone.

The Lohman 1 Peck, now drilling in Meadows field, drilled into the lower Wolfcamp horizon at 9,846 ft. (drilling time) 18 ft. lower than the discovery well ¼ mile east. After drilling to 9,872 ft., the well blew out making large quantities of gas and 48°-gravity oil before being killed. The well was brought under control and drilled through the pay indicating a thickness of 36 ft. of porosity.

The Pennsylvanian limestone pay from 10,310 to 10,428 ft. is 300 ft. below the top of the Pennsylvanian and is the uppermost formation in which commercial production is indicated. On drill-stem tests, gas and fluid rise to the surface within a short period and oil flows upwards from 20 bbl. per hour. The gravity of the oil is 42° in Meadows field. The age of this pay is variously reported as Cisco and Canyon with the shale section below classified as Strawn or Bend. The writer prefers the Canyon and Strawn identification, but much is yet required to definitely establish the group identity.

Several zones of fractured and porous limestone occur in the upper part of the Devonian from 11,800 to 12,200 ft. Drill-stem tests yield gas to the surface and recover gas-cut mud with trace of distillate. Results have not been obtained to show this section to have an oil column, but oil should be encountered in wells located structurally lower than the discovery well. This section is not well developed in Pegasus field.

Oil flowed at an estimated rate of 25 to 35 bbl. per hour on drill-stem test in the first porosity of the lower Devonian section which extends from 12,280 to 12,390 ft. and consists of at least three zones of good fracture and solution porosity. Considerable difficulty is encountered in drill-stem testing this section because of failure of packers to hold in the fractured limestone and chert. The gravity of the oil is 46°.

The Fusselman formation in the lower part of the Silurian varies in thickness from 60 to 90 ft. and has been found slightly to fairly porous and saturated in all wells drilled. As a rule drill-stem tests of this formation fail to yield free oil, but relatively small amounts of oil have been

recovered in one or two wells. On formation tests in the Fusselman, gas rises to the surface and recoveries show very heavily gas and oil-cut mud with trace of free oil. Acidizing is considered necessary to make a satisfactory completion in the Fusselman, but attempts to dually complete with the Ellenburger have thus far been unsuccessful. This zone in the Peck well is from 12,464 to 12,548 ft.

Saturation has been encountered in various zones of the Ellenburger dolomite in all wells drilled to date. Drill-stem tests result in gas to the surface in a few minutes and flow oil at a rate upwards to 50 bbl. per hour. Seven wells have been completed in this formation of which two were through casing perforations and five were in open hole. The depths at which saturation was found in the Meadows field discovery are 13,128 to 13,338 ft. The gravity of the oil is 53°.

No water level has been encountered in any of the above formations in either field except in the Ellenburger and the lack of consistency in the depths at which water has been found and the character of data pertaining to the water level is such that it is not known at the present time where the water-edge limits of production are. Magnolia attempted 14 drill-stem tests in the Ellenburger at 50-ft. intervals.

An hour test 13,087-13,192 ft. recovered 150 ft. of mud and the next test from 13,256 to 13,295 ft., open 2½ hours, recovered a 2,250-ft. water blanket, 3,900 ft. of mud, 180 ft. of salt water and gas-cut mud, and 90 ft. of mud-cut salt water. The subsea datum of the top of this test is minus 10,365 ft. The small amount of water recovered left some doubt of this being a reservoir water level.

Diagonally northwest offsetting the discovery well, Phillips Petroleum Co. is drilling a well now in process of completion. The Ellenburger was penetrated at a subsea depth of minus 10,093 ft. and several drill-stem tests, under heavy water blankets, yielded incomplete data on the reservoir.

In a test from 13,090 to 13,155 ft. (minus 10,266 ft.) 1,672 ft. of free oil was recovered. A test 13,155-13,220 ft. (minus 10,331 ft.) recovered 4,500 ft. of gas-cut water blanket and 190 ft. of slightly oil-cut mud. From 13,369 to 13,420 ft. (minus 10,531 ft.) a 4,800-ft. water blanket and 10 ft. of mud with no show were recovered. A similar test was made 13,469 to 13,520 ft. and water blankets and small amounts of mud with no shows were recovered in tests down to 13,603 ft. (minus 10,714 ft.). A 2-hour test 13,603 to 13,703 ft., using 5,100 ft. of water, recovered the water blanket, 60 ft. of oil and gas-cut mud, and 300 ft. of salt water. The indication of water in this well 350 ft. below the depth at which water was recovered in the Magnolia well makes a common water level for the reservoir unknown at this time.

In Meadows field discovery well three drill-stem tests were made prior to setting casing at 13,336 ft. (minus 10,434 ft.).

Slight porosity with some stain and fluorescence in the samples were obtained to approximately 13,350 ft. and a drill-stem test from the bottom of the casing to total depth (13,399 ft.) recovered a 510-ft. water blanket and 12,829 ft. of slightly gas and oil-cut sulfur water. A water level is here indicated at minus 10,450 ft., but dense barren dolomite between the water-bearing porosity in the bottom of the hole and the oil-bearing porosity 13,128-13,250 ft. suggests that more wells will be required to determine the water level in these porous zones.

Formation Data and Reserves

Total net thickness of the gas and oil columns of the various reservoirs in Meadows field have yet to be determined by future wells. The productive limits of each horizon likewise is unknown at the present time and may only be estimated on the basis of geophysical data.

Sample analyses, examination of cuttings, drill-stem tests, a reservoir-fluid analysis and bottom-hole-pressure survey of the Ellenburger, and other data have been studied in detail to arrive at an estimate of the recoverable reserves in this field.

Based on the above-mentioned data it is estimated that the ultimate recovery of oil from all horizons will exceed 75,000 bbl. per acre. The field may eventually cover from 10 to 15 sections.

Stratigraphy and Structure

The stratigraphic column represented in Pegasus and Meadows fields is similar to that known in the deep Midland basin. Many more deep wells must be drilled and samples examined before the detailed stratigraphy is worked out. Under a thin surface covering of the Ogallala formation (Pliocene) lies approximately 200 ft. of Lower Cretaceous Washita, Fredericksburg, and Edwards. The Triassic section is from 1,400 to 1,500 ft. thick and is represented by the Chinle and Santa Rosa formations of the Dockum group. In the 8,300-8,750 ft. of Permian formations is the first stratigraphic variation of interest.

Table 1 gives the datum tops of the wells in Pegasus and Meadows fields as used for structural correlation purposes only. Differences of opinion exist in the selection of formation tops by sample examination and interpretation of electrical logs and all data in this table are based

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on correlative markers on the logs.

Attention should be called to the thickness of the interval from the top of the Permian to the top of the Spraberry which varies only by 100 ft. in the 6,000-ft. section. In the interval from the top of the Spraberry to the base of the Permian, a variation of 400 ft. is observed in 2,300 ft.

The Pennsylvanian is about equally divided between two groups, probably Canyon and Strawn, although Cisco and Bend identifications habe been applied by some geologists. The thickness varies from 1,100 ft. in Pegasus to 1,400 ft. in Meadows, indicating a westward thickening in the Pennsylvanian in contrast to the eastward thickening noted above in the lower Permian.

The Woodford shale of the Mississippian is generally uniform in thickness, but the Devonian thickens from 700 ft. in Pegasus to 860 ft. in the Peck well, a thickening corresponding to the Pennsylvanian. The underlying Silurian shale and Fusselman limestone and the Montoya and Simpson formations of the Ordovician are relatively uniform in thickness in each field with variations due to structural conditions rather than stratigraphic variations.

The Pegasus and Meadows structures are only known in general at this time. Both are asymmetrical anticlines of fairly large breadth and elongated north-south. A steep west or northwest dip is indicated in the Pegasus field and steep east dip is suggested by geophysics in Meadows.

Drilling Conditions

The drilling conditions in Pegasus and Meadows fields are typical of the Midland basin and require no special mud or casing program. Thirteen and three-eighths inch surface casing is set at approximately 350 ft. below which wells are drilled to the top of the San Andres with clear water. A string of 9⅝-in. casing is set 4,600-4,900 ft. to eliminate the salt and red bed section, although in some wells this casing is set through the San Andres porosity.

Below the salt string of casing operators attempt to drill as deep as practical with clear water and a few of the wells have been drilled through the zone of lost circulation from 6,000 to 7,000 ft. without mudding up or using lost-circulation material. Most wells have been drilled with a string of protection casing (7⅝-in.) set on top of the Wolfcamp at approximately 9,100 ft. This string is set with a backoff joint for recovery after setting the production string.

Below 8,000 ft. most wells have been mudded up and lost circulation material used. The mud characteristics vary around a weight of 9.2, viscosity of 36, water loss of 50 or more, and filter cake measuring 8/32 in. After setting the protection string of casing, the lost circulation is removed and the mud weight and viscosity raised to 10 and 45 with water loss of 11 and filter cake of 2/32 in. Below 10,700 ft. the viscosity is raised again and water loss cut for drilling the black shale section of the lower and pre-Pennsylvanian formations.

The Devonian chert section is the most difficult drilling encountered in this area. In penetrating these hard zones bits average from 5 to 20 ft. of hole before having to be replaced. The basal Simpson sand is also very hard to penetrate due to high induration. Bits average less than 10 ft. of hole in drilling through this section.

With additional drilling history being made currently it is anticipated that drilling costs will be reduced and the time required to drill the wells shortened. Over 11 months were consumed in drilling and testing the Pegasus field discovery and information gained by the drilling of this well helped to reduce the time required in the Meadows field discovery to 6 months. Devonian wells should be drilled and completed in 4 to 5 months and Pennsylvanian wells will require 2 to 3 months to complete.

Acknowledgments

The writers gratefully acknowledge the permission of the General American Oil Co. of Texas to publish this paper; the assistance of Sibley Dale for the preparation of illustrations.

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Porosities Can Be Obtained From Radioactivity Logs in West Texas

Example of Quantitative Interpretative Technique Shown for Scurry County

by R. E. Bush*

THE basic concept of quantitative interpretation of radioactivity logs was introduced in a paper in October 1949,[1] and **the exponential relationship of the Neutron Curve to porosity** was set forth at length. It shall be the purpose of this paper to introduce new developments in this method of log interpretation and by an example show the detailed procedure necessary for establishing the base log for a field. The examples used are hypothetical and are intended to show technique only rather than an actual interpretation of a specific log in a specific area.

Purpose of Base Log

To establish a base log for a field, formation, or area, a general procedure is followed in every case. It is the purpose of this procedure to determine the arithmetic average of the neutron deflections in relation to the corresponding porosities determined by core analysis. This requires a radioactivity log run on a well that has been cored through a section giving sufficient porosity variations to establish a **neutron derived porosity curve** from the relationship of the neutron deflections to core porosity. The relationship of the neutron curve to core porosity has been fully discussed.[1] However, due to the importance attached to the sampling of the neutron curve in relation to cores, it might be well to remind the reader that the type and accuracy of core analysis has great importance in the establishment of basic data.

Long core or bulk volume core analysis has been found to offer the most reliable results, while plug core anal-

*Division sales geologist, Lane-Wells Co., Dallas.

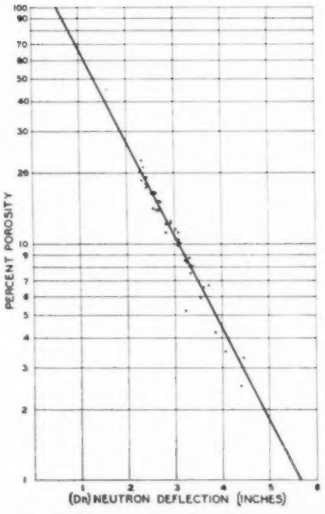


Fig. 2—Neutron derived porosity curve.

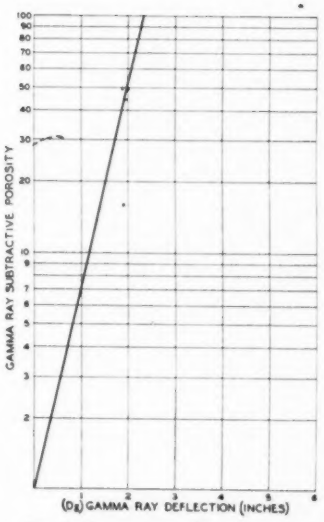


Fig. 3—Gamma ray subtractive curve.

Fig. 1—(Below) Base log for determination of correction curves.

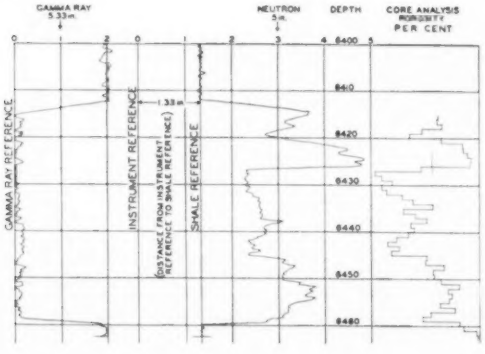
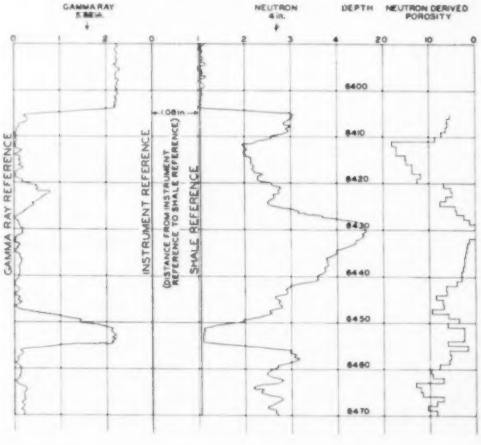


Fig. 4—(Right) Well No. 2, unknown log.



ysis is usable only where the porosity distribution is horizontally homogeneous. In some cases, it is necessary to determine from this same data a gamma ray subtraction curve to correct for the effect of shale deposited in this formation. Once these correction curves have been determined for a field, they will apply to other radioactivity logs of wells that have not been cored with the limitation that the hole diameter, casing program, and lithology remain constant. Where changes in completion program occur in any field, it is, therefore, necessary that a new base well be selected for each variation in the completion technique.

In this paper, an example of the technique of establishing the necessary correction curves for quantitative interpretation of a 6¼-in. open-hole well completion will be shown. It must be understood that the data shown are hypothetical to the extent that the data are not actual logs and cores; however, the neutron derived porosity curve is derived from a number of quantitative interpretations in the Canyon reef limestone of Scurry County, Texas, and is applicable to other radioactivity logs of wells in this area drilled to a 6¼-in. bore diameter, which are uncased through the Canyon reef.

Quantitative Interpretation Technique

Using the data obtained from the example well, a complete quantitative interpretation will be made with particular reference to technique. The first step in this type of interpretation is the selection of a reference line on the radioactivity log for the gamma ray curve and the neutron curve. These reference lines at the present writing may be best established by two methods, the relative zero reference and an instrument reference.

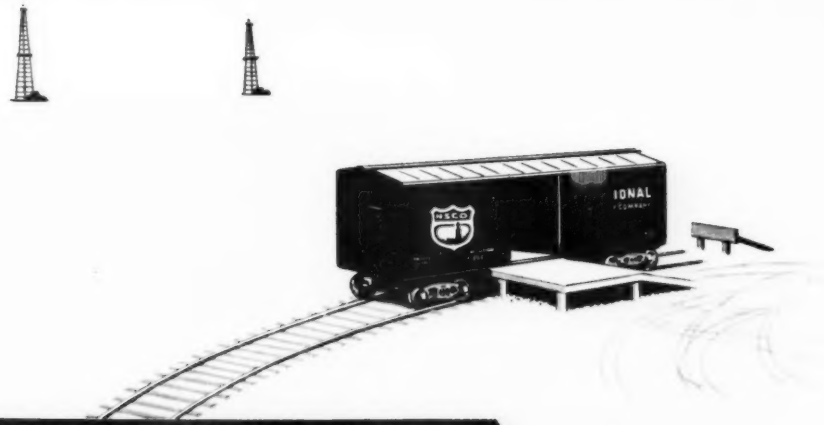
Relative zero reference. — Careful examination of the logs in the Scurry area reveal that the most reliable reference point may be obtained by averaging the shale line that appears on the log immediately above the Canyon reef limestone. This shale line average is obtained by selecting the lowest shale deflections on the neutron curve and averaging their linear values (Fig. 1). This line may be utilized as the reference for the neutron curve by proper consideration of the curve sensitivity. For purposes of uniformity, it will generally be advantageous to convert this reference line to an instrument reference to insure that all determinations may be made from a common reference point. This conversion will be discussed under section on instrument references.

TABLE 1—DATA SHEET, XYZ OIL CO. WELL NO. 1, SCURRY COUNTY, TEXAS

1 R A log depth	2 (Dn) Neutron deflection	3 Neutron porosity	4 Core porosity	5 (Dg) Gamma ray deflection	6 Subtractive porosity
6,415-16	33.3	8.10	8.70		
6,416-17	3.13	10.30	9.00		
6,417-18	3.36	7.80	7.90		
6,418-19	2.93	11.70	12.30		
6,419-20	2.71	14.20	15.00		
6,420-21	3.37	7.90	8.00		
6,421-22	4.08	4.15	3.50		
6,422-23	4.47	2.90	3.30		
6,423-24	4.43	3.01	2.50		
6,424-25	4.83	2.09	1.85		
6,425-26	4.81	2.12	2.00		
6,426-27	2.93	11.60	12.30		
6,427-28	2.33	20.00	22.50		
6,428-29	2.26	21.40	21.00		
6,429-30	2.34	19.90	18.50		
6,430-31	2.36	19.50	21.00		
6,431-32	2.31	20.40	20.00		
6,432-33	2.53	16.70	16.45		
6,433-34	2.58	16.00	14.20		
6,434-35	2.58	16.00	10.00		
6,435-36	2.63	15.20	16.30		
6,436-37	2.65	15.00	13.80		
6,437-38	3.10	10.00	11.10		
6,438-39	2.68	14.60	13.90		
6,439-40	2.75	13.70	13.00		
6,440-41	2.68	14.60	15.10		
6,441-42	2.43	18.30	17.80		
6,442-43	2.38	19.20	19.90		
6,443-44	2.42	18.60	17.30		
6,444-45	2.43	18.40	19.00		
6,445-46	2.83	12.70	11.20		
6,446-47	3.05	10.50	11.50		
6,447-48	3.36	7.90	7.50		
6,448-49	3.13	9.70	10.00		
6,449-50	3.08	10.20	9.90		
6,450-51	3.28	8.50	8.30		
6,451-52	3.81	5.25	4.20		
6,452-53	3.74	5.60	6.70		
6,453-54	3.56	6.55	5.90		
6,454-55	3.63	6.18	6.50		
6,455-56	3.25	8.70	8.50		
6,456-57	3.20	4.85	5.20		
6,457-58	3.11	9.90	10.30		
6,458-59	2.83	12.70	12.10		
6,459-60	2.33	20.10	4.30	1.40	15.80
6,460-61	1.38	47.50	3.40	1.95	44.10
6,461-62	1.33	50.00	.50	2.00	49.50
6,462-63	1.33	50.00	.30	1.87	49.50

TABLE 2—DATA SHEET NO. 2, XYZ OIL CO. WELL NO. 2, SCURRY COUNTY, TEXAS

1 R A log depth	2 (Dn) Neutron deflection	3 Neutron porosity	4 (Dg) Gamma ray deflection	5 Subtractive porosity	6 Neutron derived porosity
6,405-06	3.03	5.35			5.35
6,406-07	2.93	6.00			6.00
6,407-08	2.95	5.90			5.90
6,408-09	2.89	6.30			6.30
6,409-10	2.76	7.25			7.25
6,410-11	2.60	8.70			8.70
6,411-12	1.95	18.00			18.00
6,412-13	2.00	17.00			17.00
6,413-14	1.98	17.60			17.60
6,414-15	2.12	15.00			15.00
6,415-16	2.13	14.90			14.90
6,416-17	2.20	13.60			13.60
6,417-18	2.20	13.60			13.60
6,418-19	2.35	11.70			11.70
6,419-20	2.28	12.50			12.50
6,420-21	2.58	8.90	.40	2.08	6.82
6,421-22	2.70	7.75	.50	2.50	5.25
6,422-23	2.60	8.70	.72	3.70	5.00
6,423-24	2.55	9.20	.60	3.00	6.20
6,424-25	2.50	9.70	.42	2.12	7.58
6,425-26	2.95	5.85	.30	1.75	4.10
6,426-27	3.30	3.95			3.95
6,427-28	3.85	2.12			2.12
6,428-29	4.43	1.11			1.11
6,429-30	4.64	1.00			1.00
6,430-31	4.60	1.00			1.00
6,431-32	4.60	1.00			1.00
6,432-33	4.40	1.14			1.14
6,433-34	4.20	1.43			1.43
6,434-35	3.98	1.83			1.83
6,435-36	3.90	2.00			2.00
6,436-37	3.80	2.23			2.23
6,437-38	3.80	2.23			2.23
6,438-39	3.72	2.45			2.45
6,439-40	3.62	2.75			2.75
6,440-41	3.60	2.81			2.81
6,441-42	3.30	3.95			3.95
6,442-43	2.90	6.20			6.20
6,443-44	2.92	6.10			6.10
6,444-45	2.62	8.50			8.50
6,445-46	2.78	7.10			7.10
6,446-47	2.82	6.80			6.80
6,447-48	2.52	9.50			9.50
6,448-49	2.48	10.00	.80	4.30	5.70
6,449-50	1.98	17.50	1.45	13.90	3.60
6,450-51	1.60	27.00	1.70	21.00	6.00
6,451-52	1.05	50.00	2.15	48.80	1.20
6,452-53	1.05	50.00	2.15	48.80	1.20
6,453-54	1.05	50.00	2.15	48.80	1.20
6,454-55	1.05	50.00	2.10	44.00	6.00
6,455-56	3.00	5.50	.75	3.92	1.58
6,456-57	2.98	5.65			5.65
6,457-58	3.08	5.05			5.05
6,458-59	3.00	5.55			5.55
6,459-60	2.70	7.75			7.75
6,460-61	2.50	9.70			9.70
6,461-62	2.55	9.20			9.20
6,462-63	2.82	6.80			6.80
6,463-64	2.25	12.90			12.90
6,464-65	2.40	10.90			10.90
6,465-66	2.45	10.30			10.30
6,466-67	2.80	6.95			6.95
6,467-68	2.65	8.20			8.20
6,468-69	2.45	10.30			10.30
6,469-70	2.65	8.20			8.20



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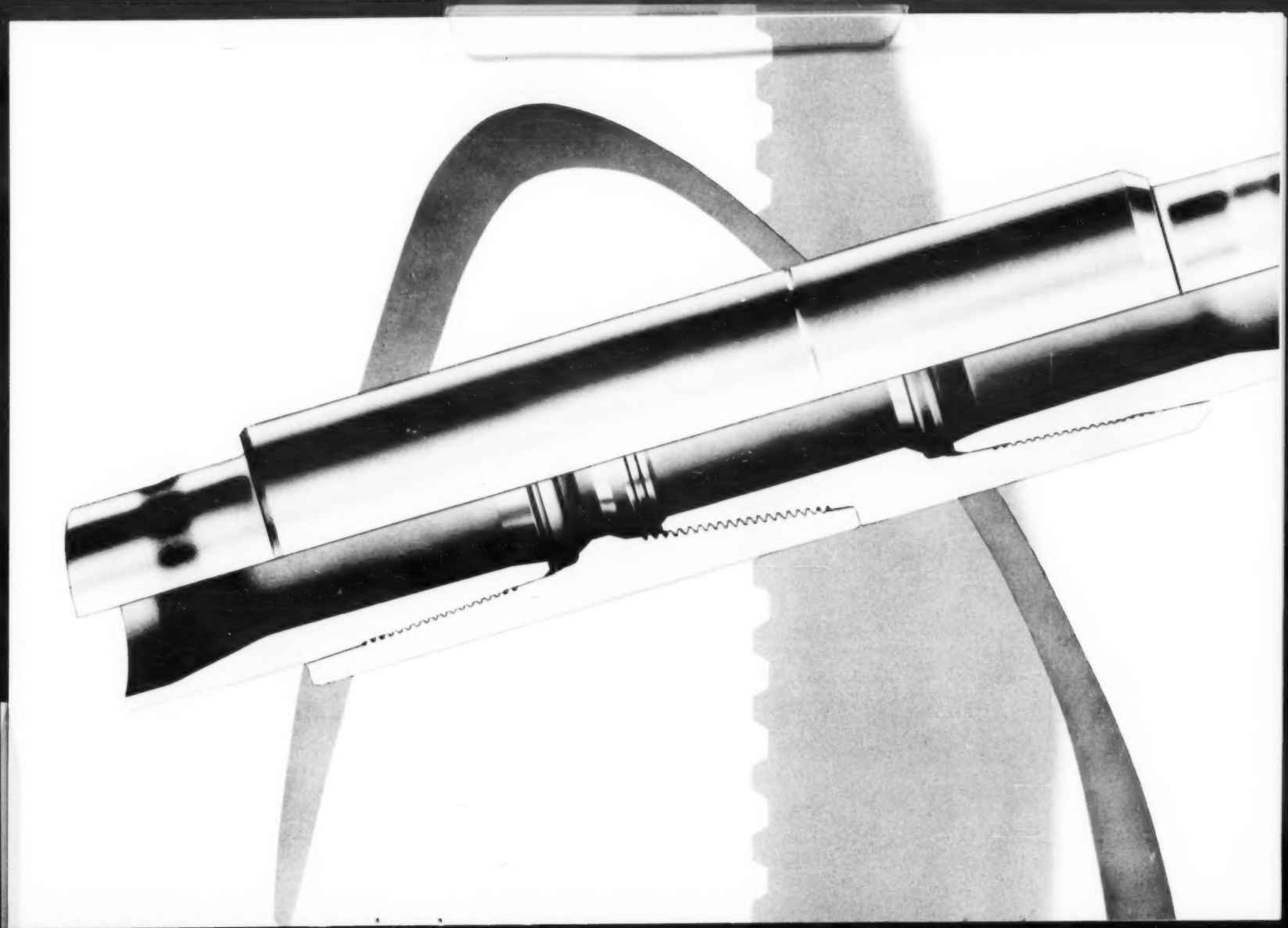

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Instrument reference. — Instrument references may be measured at the surface before and after a neutron curve has been made. Fig. 1 shows the placement of the instrument reference for the example log. To convert a relative shale reference to an instrument reference, it is necessary that log sensitivity be discussed.

The sensitivity that appears in the body of the radioactivity log for the gamma ray and neutron curves is determined by placing a given standard of radioactive material opposite the ionization chamber and recording the pen travel obtained. The sensitivity is expressed as the number of inches of pen travel obtained by the placement of the standard on the ionization chamber.

These standards are referred to as a 274 standard for the gamma ray curve and 275 standard for the neutron curve. The distance from the shale reference to the instrument reference is measured as 1.33 in. on the log shown in Fig. 1.

A conversion factor may be established by dividing 1.33 in. by the sensitivity of the correction log, in this example 5 in., to give the conversion factor of 0.266. This conversion factor may then be applied to a log of a well that does not have an instrument reference, by multiplying the sensitivity of the new log by the conversion factor to determine the distance in inches that the instrument reference lies to the left of the shale reference. This procedure is followed for the sake of uniformity, and to permit the measurement of neutron deflections from the same reference in this area.

It should be noted that the conversion factor 0.266 is thought to be applicable only in the Canyon reef fields of Scurry County to wells in which 7-in. casing was set through the shale above the reef with 6¼-in. open hole through the reef. Fig. 4 illustrates the application of the conversion factor to an example log of a well that falls within these limitations. The reference line for the gamma ray curve may be established by selecting the lowest deflection shown on the gamma ray curve within the Canyon reef.

Radioactivity Log vs. Core Porosity

To establish the **neutron derived porosity curve,** it is necessary to correlate without reference to depth the neutron curve with a graph of the core porosity on the same vertical scale. Great care must be exercised in establishing this correlation. When the correlation has been made, it has been found advantageous to record on a data sheet similar to that shown in Table 1 the depth correlation of each sample analyzed, with the corresponding depth on the radioactivity log.

The radioactivity log and the core graph are then traced on coordinate paper in order that the position of each core sample analyzed may be graphically established in relation to the neutron curve. By placing a straight edge in the center of the core sample and reading in inches the gamma ray deflection and the neutron deflection from their respective reference lines, the data necessary from the radioactivity log may be recorded on the data sheet in Column 2 under the heading "Dn" (deflection neutron) and in Column 5 under the heading of "Dg" (deflection gamma ray).

All of the measurements necessary from the radioactivity log have then been recorded on the data sheet and all further determinations may be accomplished from this source. The core porosity for each respective radioactivity log depth is recorded in Column 4. All the data necessary to determine the neutron derived porosity curve and the gamma ray subtraction curve has now been recorded on the data sheet.

To eliminate the effect of shaly material, it is necessary that only the portions of the radioactivity log having a gamma ray deflection less than 0.2 in. be considered. Where the gamma ray deflection is less than 0.2 in., the neutron deflections are plotted against the logarithm of porosity to establish the neutron derived porosity

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curve. This is accomplished by plotting on semilog graph paper the neutron deflections as the abscissas versus the corresponding core porosity as the ordinate (Fig. 2).

The neutron derived porosity curve is then drawn by taking the average of the scattered points. It must be remembered that this curve has been expressed in inches of deflection for a given sensitivity and is applicable to any radioactivity log within the limits of casing and bore size after proper consideration of the sensitivity of the unknown log. To complete the data sheet, the neutron porosity is determined from the neutron porosity curve using the neutron deflection in Column 2 and the neutron porosities are recorded in Column 3.

Gamma ray subtraction curve.—The gamma ray subtraction curve is determined for use where shale is present within the producing section. Chemically combined water present in shale or shaly limestone will cause the neutron curve to exhibit characteristics of porosity higher than are actually present, therefore, it is necessary that the effect of the apparent shale porosity be subtracted to obtain the true porosity of the bed. This is accomplished by reading the neutron porosity from the neutron derived porosity curve for the portion of the radioactivity log having high gamma ray deflections and recording these neutron derived porosities in Column 4 on the data sheet.

The neutron derived porosities, where affected by shale, will usually be larger in value than the core porosity for the sample. It should be remembered, however, that high deflections on the gamma ray curve are not always associated with shale, and may be attributed to an increase in radioactive materials in the bed, not necessarily associated with chemically combined water. Therefore, the gamma ray subtractive curve is only necessary in the Canyon reef where shale is indicated from the sample log.

To determine the effect of the shale, the core porosity (Column 4) is subtracted from the apparent neutron porosity (Column 3) and is recorded in Column 6 as the gamma ray subtractive porosity. This porosity variation is thought to be an exponential variation just as is the variation of the neutron curve with core porosity and is, therefore, plotted as the ordinate on semilog graph paper versus the gamma ray deflections (Fig. 3). The average of these scattered points will determine the gamma ray subtractive curve.

The gamma ray subtractive curve is expressed in inches of deflection and may be applied to any other gamma ray curve in the area within the limitations of casing and bore conditions after proper consideration of curve sensitivity.

Application to Other Wells

To illustrate the application of the neutron derived porosity curve and the gamma ray subtractive curve, determined from the base log, an example is shown of a radioactivity log of an unknown well in the Can-

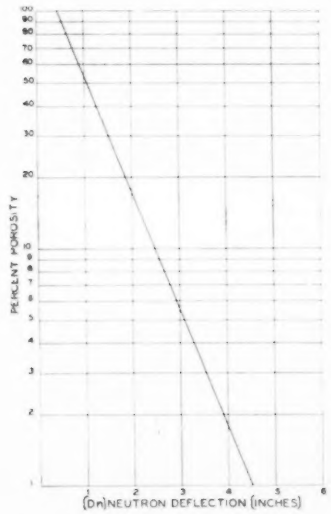

Fig. 5—Neutron porosity curve.

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yon reef of Scurry County prepared for the application of the correction curves (Fig. 4). It has been assumed that this log was run under the same casing and bore conditions as the base log.

To show the method of conversion from a shale line reference to an instrument reference, it has been assumed that this log had no instrument reference. The shale line was determined and the sensitivity of the log was noted as 4 in. By multiplying the conversion factor 0.266 by the sensitivity of the log (4 in.), it is found that the instrument reference is 1.065 in. from the shale line. Neutron deflection measurements may then be made from the instrument reference for the sake of uniformity.

The data sheet is utilized to record all the necessary data for determining the porosity from the radioactivity log (Fig. 5). Readings are taken at the center of every 1-ft. division for the neutron deflection (Dn) and recorded in Column 2 and for the gamma ray deflection where the gamma ray exceeds 0.2 in. (Column 4). All the data necessary from the radioactivity log has now been recorded on the data sheet.

To determine the neutron derived porosity, it is necessary to note the sensitivity of the neutron curve; in this case 4 in. The base log had a

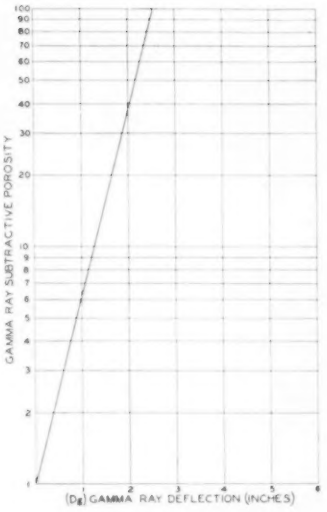

Fig. 6—Gamma ray subtractive curve.

sensitivity of 5 in. and a correction must be made for this change in sensitivity. This may be done by selecting one high-porosity point and one low-porosity point and reading the deflection at which the neutron derived curve for the base log (Fig. 2) intersects the porosities selected. The porosities selected for correction were 30 per cent and 1 per cent. The deflection on the base curve (Fig. 2) at which the neutron porosity curve intersected 30 per cent was 1.89 in.

A proportional correction for this point for the change in sensitivity may be made as shown:

$$5 : 1.89 \text{ as } 4 \text{ in.} : D$$

$$D = \frac{4 \times 1.89}{5}$$

$$D = 1.51 \text{ in. of deflection}$$

This deflection was then plotted on the 30 per cent porosity line as shown in Fig. 5. To determine the slope of the curve, the second correction porosity 1 per cent was treated in the same fashion. The intersection of 1 per cent and the neutron porosity curve was 5.65 in.

Therefore:

$$5 : 5.65 \text{ as } 4 : D$$

$$D = 4.52 \text{ in. of deflection}$$

This deflection is plotted on the 1 per cent porosity line (Fig. 5) and the two points connected to give the neutron derived porosity curve for this log. By the same proportional correction, the gamma ray subtractive curve is corrected to the new sensitivity of 5.88 in. for this log (Fig. 6).

With the neutron deflections and gamma ray deflections recorded on the data sheet, the neutron porosity

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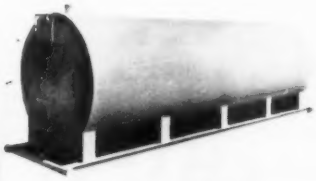

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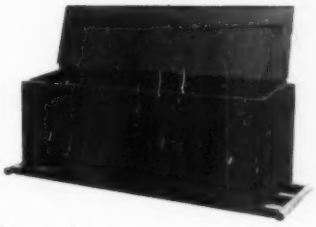

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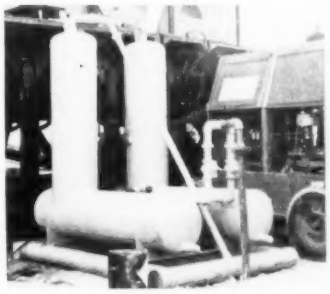

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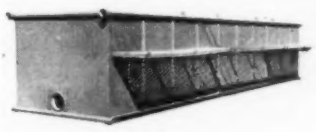

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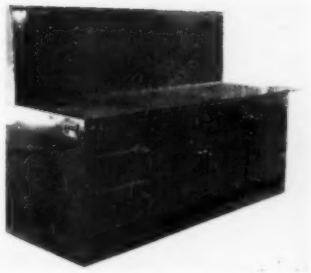

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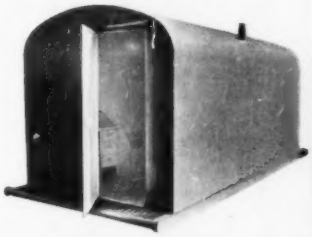

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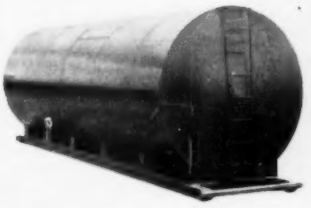

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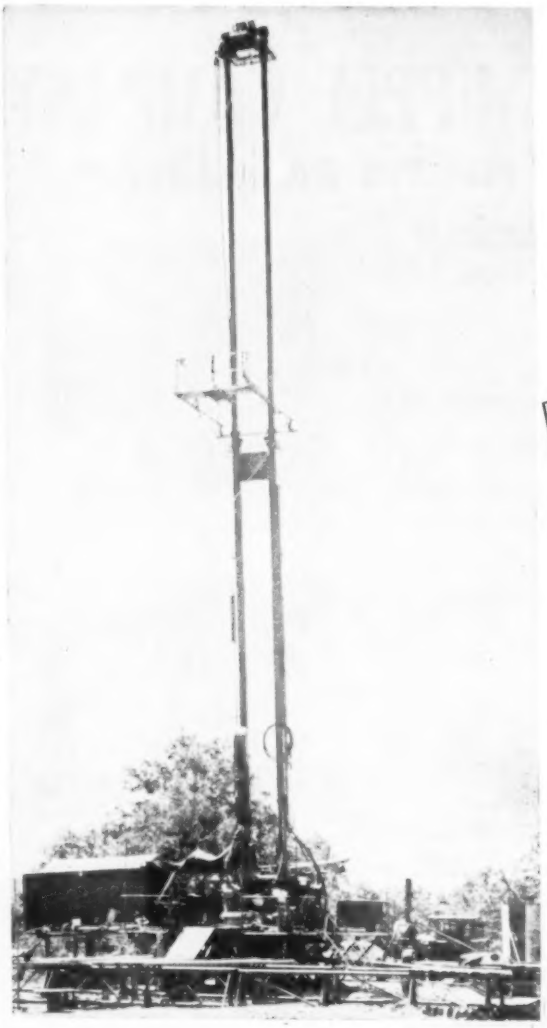

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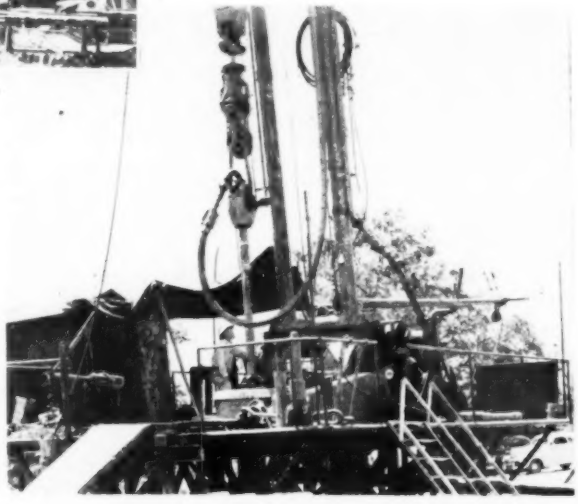

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and the gamma ray subtractive porosity (where applicable) are determined from the corrected neutron derived porosity curve and the corrected gamma ray subtractive curve, and the values recorded in Columns 3 and 5. The gamma ray subtractive porosities were determined only where the gamma ray deflection was greater than 0.2 in. The gamma ray subtractive porosity is then subtracted from the neutron porosity to give the neutron derived porosity which is recorded in Column 6.

The neutron derived porosity has been plotted on a graph (Fig. 5) to show its relation to the neutron curve. A much more rapid method of determining the neutron derived porosity may be had by determining a graphic porosity scale from the neutron porosity curve.

Summary

It has been shown that a radioactivity log may be used as a means of determining porosity within a field or area by selecting a cored well which has been logged by radioactivity logging devices as the base well from which a neutron derived porosity curve and a gamma ray subtractive curve may be determined. These curves may then be applied to uncored or unknown wells that have the same bore hole diameter and casing program as the base well after proper consideration of log sensitivity has been made. For wells having a different bore diameter or casing program, other base determinations must be made until all conditions existing in the field have been satisfied. While these methods are not based on absolute measurements, they approach absolute measurements very closely and offer the advantage of rapid conversion to absolute measurements when they are available. All examples discussed are based on a number of quantitative interpretations of radioactivity logs of wells in the Scurry County, Texas, Canyon reef limestone, and the neutron derived porosity curve shown is applicable to the radioactivity logs of other uncased wells in this area drilled to 6¼-in. bore diameter.

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BOOKS

FIRST ANNUAL INSTITUTE ON OIL AND GAS LAW, SOUTHWESTERN LEGAL FOUNDATION, DALLAS. Published by Matthew Bender & Co., Inc., 109 State Street, Albany, N. Y. 632 pp. $16.50.

Executives and legal advisers from a wide swath of the oil and gas industry were in attendance at the conference reported on in this volume. Both groups gained greatly from the clear analyses of the legal structures, the balancing of the many tax factors which oil men have to consider, and the explanation of economic interrelationships. Due to the fact that the papers were prepared for oral delivery, they are remarkably easy to follow. They are neither too legalistic, nor cluttered with the secret language of higher economics. They are intended to be used, and are slanted for the practical man who has real problems to decide in his administrative work. The book should prove highly useful as a reference work.

BEST'S SAFETY DIRECTORY OF SAFETY, FIRST-AID, HYGIENE, AND FIRE-PROTECTIVE METHODS, 1950-1951. Published by Alfred M. Best Co., Inc., 75 Fulton Street, New York 7. 511 pp. $5.

This directory combines practical features of a safety manual, directory, index, encyclopedia, and catalog. It has a well-conceived indexing and subject-grouping system. These devices, plus numerous illustrations, make it easy to locate safety products even when the user is not certain of the type or name of the product he needs. The logical arrangement of subjects also serves as a checklist of hazards.

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DEVELOPMENTS IN

Corrosion Prevention

IN WEST TEXAS

by H. D. Murray and W. H. Crenshaw

DURING the past 2 years, greater attention has been paid by many operators to the effects of corrosion on oil-field equipment in West Texas and the Permian basin. The operators of various types of equipment have followed various paths in their attempt to reduce the costly effects of this corrosion.

The oil producer has, perhaps, made the greatest change in new lease storage. More operators are now coating only the bottom and 18 in. of the side walls of new lease tanks when they are installed. Where aluminum decks are not used, the steel deck and upper vapor space are usually coated also. Improved coating materials have been developed that give greater promise of protection than has been afforded in the past.

Where lease-tank bottoms have deteriorated to a state that normally would require replacement, a method has been developed that allows satisfactory repair by the use of a thermosetting plastic and an inert filler. This repair operation costs approximately 50 per cent of the cost of replacement of the bottom steel. The resultant bottom consists of a plastic and filler film approximately ⅛ in. thick over the entire bottom of the tank plus a coating extending at least 12 in. up the side walls of the tank.

H. D. Murray is coowner of Cren-Ray Plastic Products Co., Midland, Tex. He received B.S. degree in engineering from Texas A. & M. College in 1931. Since 1934 he has been engaged in oil and gas-well drilling and production activities with the exception of 4 years spent in the Army during World War II. He worked from roustabout up to district petroleum engineer with The Texas Co., production department, before joining Crenshaw in forming their present company.

Coauthor W. H. Crenshaw operates American Inspection Service at Midland, together with Cren-Ray Plastic Products Co. He graduated in 1942 from Southern Methodist University; also attended Texas Technological College and University of Texas.

Applicators of protective coatings have developed new techniques designed to safeguard and improve the quality of their applications. Notable in this regard is the use of suction-type cleaners to facilitate the removal of blasting sand and sand dust which accumulates on the tank surfaces during the cleaning operation. Other applicators are thoroughly washing the surface to be coated after the blasting operation is completed but before the coating is applied.

Some applicators are checking the applied coating for film thickness and holidays with approved thickness gages and holiday detectors. In other instances, the customer is making these checks before final acceptance of the job. In several cases, individual companies have established minimum coating thicknesses and have incorporated these into their coating specifications.

A number of companies have developed and put into effect elaborate laboratory screening programs by which coatings are screened before being authorized for field application. As a result of such programs, much valuable knowledge is being gained by the customer, the applicator, and the manufacturer, opening the way to more rapid development and improvement of coatings and application procedures as well as protecting the customer from expensive field tests.

Changes Getting Wide Acceptance

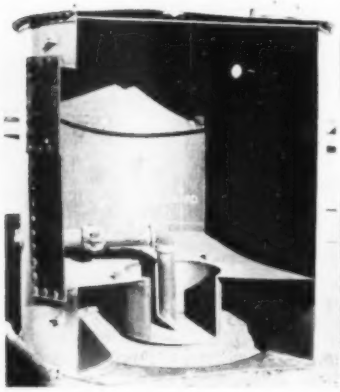
Changes in the conventional design used for many years in lease tanks are receiving wider acceptance. Cone bottoms, with and without sumps at the apex of the cone to facilitate drainage, are being installed more frequently. These bottoms are constructed so that the bottom either rests on an earthen foundation or a skirt is attached to the side walls which holds the cone bottom clear of the earth.

Fig. 1 shows a scale-model cutaway view of a welded steel tank with the attached skirt and cone bottom. Appropriate reinforcing beams are installed from the skirt to the apex of the cone properly to support the bottom and oil load, where the distance from the skirt to the apex requires such reinforcement. This type of unit is usually set on a concrete foundation ring.

Fig. 2 shows a high 500-bbl. welded steel tank with cone bottom so constructed that this bottom will rest directly on an earthen foundation.

The purpose of this change in

Fig. 1—(Left) This is a cutaway scale model of new type welded steel tank which has a cone bottom with central sump. Outside skirt holds the cone bottom clear of earthen foundation. Fig. 2—(Right) Bottom view of two high 500-bbl. welded steel tanks which have coned bottom and central sump.



design is to reduce the potential corrosion effect on the tank bottom by allowing more thorough drainage of b.s.& w. from the tank. Where the tank is skirted, as in Fig. 1, there is a possible reduction in corrosion on the underneath side of the bottom since the steel is not in contact with the soil except the small area of the sump bottom. Cleaning costs are reduced, and the flush-type cleanout plate shown in Fig. 1, is designed to facilitate such cleaning as may be necessary. Where b.s.& w. collected in tank bottoms is circulated back through treating systems, a valuable quantity of oil is conserved.

The cone bottom is applicable to either the welded steel tank or the bolted steel tank, and sumps, if used, may be constructed of ordinary or corrosion-resistant alloy steel. Late design changes permit sump removal from the inside of the tank, if replacement is necessary.

Aluminum Decks

More operators are taking advantage of the results to be obtained from the use of aluminum decks in sour-crude areas. Inspection of such decks, in use for over 13 years, indicates that such material will last an indefinite period. Regular steel decks in the same area last 2 to 4 years before replacement is necessary. Welded steel tanks have also been designed to allow aluminum deck installation.

Other operators consider that heavier steel decks, walls, and bottoms (cone bottoms included) are worth the extra dollars because the added thickness of steel requires a longer period of exposure to corrosion before requiring repair or replacement.

To allow the use of large-volume, welded, heavy steel tanks, fabricating plants have been established in the Permian basin. The popularity of this type of tank is evidenced by the expansion in productive capacity of these plants. Means of transportation have been developed that allow the effective movement of up to 1,000-bbl.-capacity tanks from these plants to the installation point. Field-welded lease tanks are also constructed by other companies, which allows the installation of larger-volume welded lease storage.

In extremely corrosive areas, where positive means of reducing corrosion in steel treaters and lease tanks have not been achieved, operators are reconsidering the use of wooden vessels in all possible instances. This forces

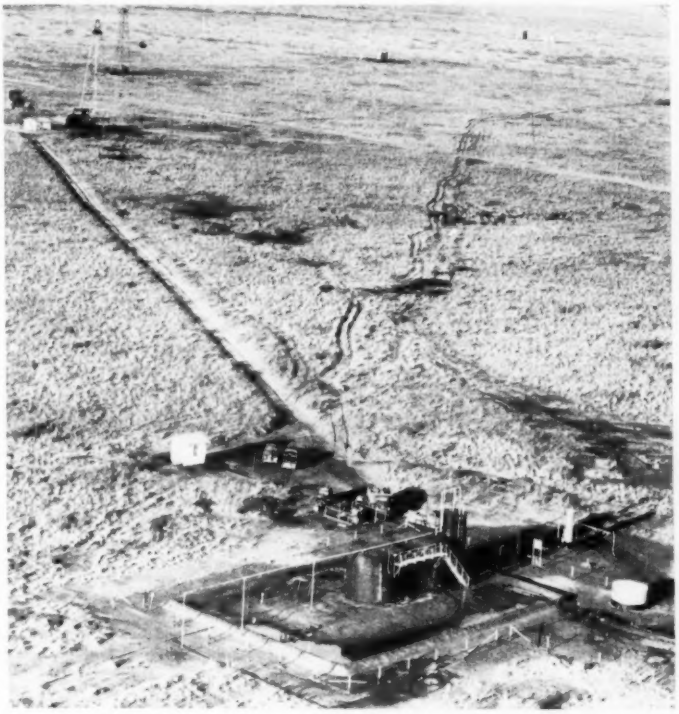


Fig. 3—Trucks and compressor units shown directly above tank battery are engaged in new method of internal application of plastic coating to pipe lines. The darkened areas in photo are places where surface leakage has previously occurred due to corrosion. The new procedure cures leaks without removing the pipe line.

Figs. 4 and 5—This pipe has been cement lined at a central plant where conditions are carefully controlled to assure uniform quality and thickness of cement.

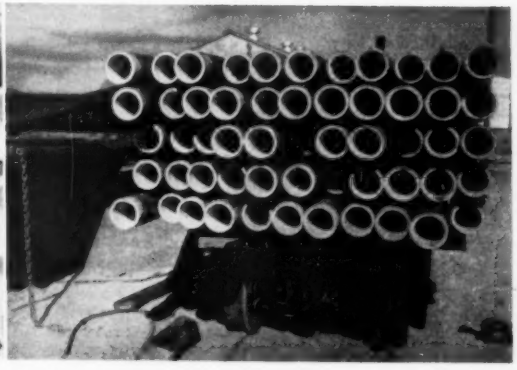


Fig. 6—Rough scale has dropped to the bottom of this tank; result has been highly accelerated spot corrosion. Many small corrosion spots are shown in this photo illustrating the problem.

the operator to use less-efficient equipment yet solves the high cost of early replacement of steel vessels.

As a result of extensive testing, inhibitors are becoming more popular for down-the-hole treatment of pumping wells located in highly corrosive areas. Preferential wetting agents are used as the inhibitors and their value lies in the fact that production casing, tubing, pumps, and rods are all protected if adequate quantities of the inhibiting agent are used. Savings in replacement of tubing, pumps, and rods will, in many cases, more than pay for the inhibitor usage. Lower labor costs for repairs, lessened production losses, and reduced damage to production casing should result in additional savings.

Attempts to reduce corrosion rates in tubing and rod strings installed in corrosive pumping wells by coating with protective coatings have had some success though the coatings are normally damaged as the coated equipment is installed or pulled from the well. More success in reducing paraffin deposition in tubing of flowing wells and between tubing and rods in pumping wells has been obtained by the application of plastic coatings. Several installations of Monel, high-nickel steel, and aluminum rods and tubing have been and are being tested in this area in an effort to aleviate corrosion problem. Some success has been achieved but further tests are necessary before drawing final conclusions.

Pipe-line operators are beginning to take advantage of a process, described in the November 3, 1949, issue of The Oil and Gas Journal, by which the interior of old or new gathering and main lines that are used for transporting oil, gas, butane, etc., and water can be cleaned and coated in place with a durable plastic coating.

Leaks from badly corroded lines have been completely stopped by application of the plastic coating, the corrosive attack has been halted, and deposition of paraffin, scale deposits, and so forth have been reduced.

The change in roughness of pipe surface is considered to have the possibility of reducing the friction head in lines that are loaded to capacity or in lines that have extremely rough surfaces. Fig. 3 shows a view of a cleaning and coating operation in progress in the West Texas area. Darkened areas are points where leakage had occurred.

Other operators are using a concrete lining for pipes to be installed in corrosive areas. Most of this lining is installed in a central plant where conditions are carefully controlled to give uniform quality and thickness of coating or lining. One installation of cement lining has been made without taking the line up and the operator reports satisfactory results. Figs. 4 and 5 show line pipe in the finishing stages of the plant lining operation.

Railhead coating and wrapping plants have recently been established in the area to permit the coating and wrapping of line pipe before installation. These installations should reduce the cost of this service and allow a greater volume of this type of protection to be used in the future.

It has been reported that some operators are testing various inhibitors in oil pipe lines but the value of these tests has not been determined.

More cathodic-protection surveys on new and old lines are being made and progress is reported on this type of protection. A local engineering service is now available for operators who do not have a trained engineering staff.

Methods and materials for coating large-volume pipe-line storage tanks have not changed radically from past practices. Most operators are awaiting results of tests in progress on lease tanks where various plastic coatings have been applied for protection. The small lease tank furnishes a more economical test unit than does the large pipe-line storage tank.

However, during recent years, many new pipe-line tanks have been installed with floating roofs. Many old installations have been modified, when repairs were necessary, by the installation of the floating roof. This feature is considered to have the possibility of reducing roof and vapor-space corrosion and reducing evaporation losses. Where scale from the roof, dropping to the bottom, has resulted in highly accelerated spot corrosion, Fig. 6, the reduced rate of roof corrosion should have the effect of reducing the spot bottom corrosion.

Inhibitors for the protection of pipe-line storage-tank roofs and vapor spaces are being tested by various operating companies. Sufficient time has not elapsed for positive evaluation but indications are considered satisfactory.

Drilling contractors continue to observe results of various attempts that are being made to reduce drill pipe and drill-collar corrosion. Some operators continue coating the interior of the drill pipe to reduce the pitting rate and resultant cracking. Others are only using the maximum in drill collar weight, keeping the drill pipe in tension throughout the drilling cycle, to reduce the corrosion effects.

It is now suspected that corrosion attack in the unengaged threads of the drill-collar tool joint may be the cause of numerous fatigue cracks which have been found in these threads during periodic inspections. Protective steps such as coating the area with plastic coating material, and anodic protection in the form of zinc and magnesium snap rings are being tried in field-service operations to determine their effectiveness. Test data to date are not sufficient to warrant any conclusions.

The program of corrosion reduction has suffered in this area, as it has in other areas, because a thoroughly organized program for solving the problem has not been arranged by the operator or operators. Recently several companies, operating in this area, have set up corrosion engineers to supervise corrosion-reduction programs in areas where this work was formerly done by engineers responsible for other more demanding duties. This approach should result in a more thoroughly supervised program.

Another technical editor confirms reasons why engineers prefer Gurley Aluminum Transits

Combining durability and lightness with precision for surveying transits

by David W. Veit
Editor, Die Castings Magazine

MANY surveying instruments built by W. & L. E. Gurley, Troy, N. Y., are accurate within one second of arc. If projected, this represents a maximum error of ⅜ inch in a mile.

However, precision is not the only requirement of these instruments. At least three other major factors influence the design and choice of materials for this type of equipment.

In the first place, a surveyor's transit must not only *be* accurate, but must maintain its accuracy over an indefinite period of years despite all sorts of weather and climatic conditions —heat, sub-zero temperatures, dampness, dust or salt-saturated atmospheres.

Second, it must withstand rough usage. This is outdoor equipment subjected to impact and abrasion.

The third requirement — no less important than the other two to the surveyor who carries the transit around all day long —is lightness.

The combination of accuracy and ruggedness could be secured by constructing the transit of heavy-sectioned castings, forgings or fabrications in steel or bronze, extensively machined and elaborately assembled. This choice of materials would, however, fail to include one significant feature—lightness.

The way in which Gurley has been able to combine all three desirable features has been by turning to aluminum for a major group of components. And since aluminum has been picked to fulfill the physical and mechanical needs of these surveyor's transits, it is not surprising that several of the most important parts are being produced most economically by die casting.

Die cast aluminum parts include the truss standard, telescope housing and leveling spider, as well as rod targets and tripod clamps. Aluminum alloys used for these transits have greater stability and rigidity than bronze. In addition, the die casting process permits unitary construction of the mounting frame, contributing further to rigidity.

From the point of view of weight reduction, aluminum die castings have permitted a 25 percent decrease in total weight, as compared with sand cast bronze. Die cast aluminum offers additional weight saving advantage, even as compared with sand cast aluminum, due to the thin, uniform wall section which is practical by die casting.

This pioneering instrument builder has used aluminum die castings wherever possible; this is one of the few production short cuts possible in a manufacturing operation characterized by extensive machining, finishing and assembling operations within close tolerances.

This company has maintained its leadership in the field of engineering and other types of instruments by a willingness to investigate and introduce into their production line the new materials and methods made available by technological advance. The excellent reputation of this company's instruments during the past century is sufficient testimony for the reliability of the materials which they use.

Reprints of the full-length article from which this is reproduced are available on request.

Field-proven over 74 years—Gurley Aluminum Transits are used from the Arctic to the Tropics. In the words of a combat engineer during World War II, "These instruments were subjected to the worst degree of heat, cold, mud, and dust a transit *should not* have. After being dropped, and everything else imaginable, they still did work up to par." The first Gurley Aluminum Transit was retired after 50 years of service to join the exhibit of Gurley "firsts." Gurley Instruments are described in Bulletin 50. Would you like a copy?

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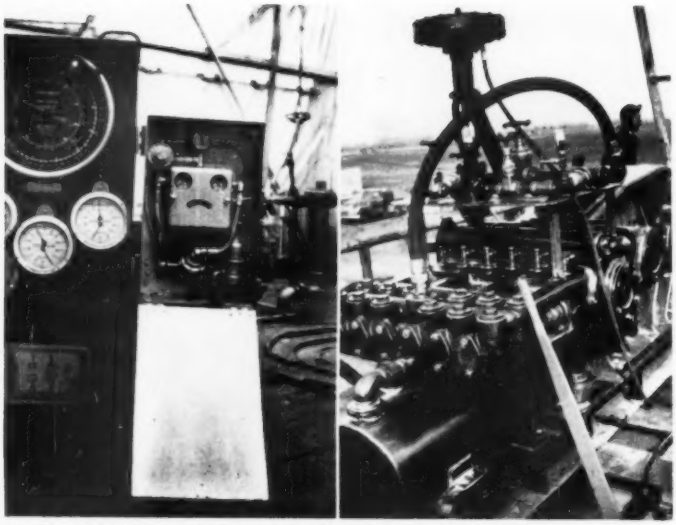


Left: A derrick-floor installation of the feed-control regulator is shown at right. (Rig of Helmerich & Payne, Inc.). The gages indicate that control is operating, and aid in adjusting bit weight. Right: The motor valve shown atop the reciprocating pump regulates the rate of discharge from the pump, which in turn controls the rate of feedoff of drilling line and the weight on the bit.

Automatic Weight Control

. . . on drilling bits achieved via weight regulator and feedoff control

by Roy F. Carlson
Dallas District Editor

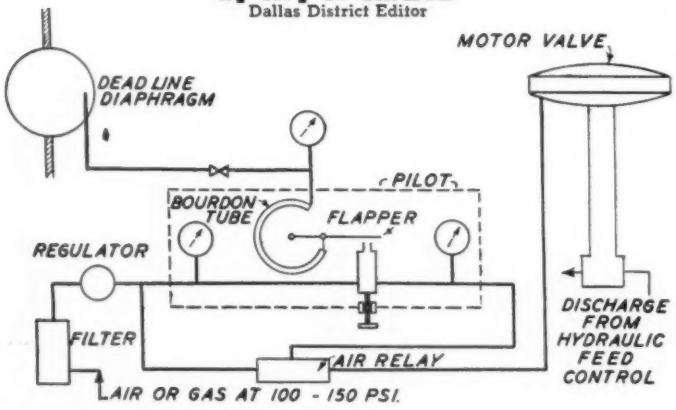
West Texas drilling contractors will be particularly interested in this article. The weight control unit described was used on the rig in Benedum field which drilled 10,024 ft. in 38 days (see The Oil and Gas Journal, August 18, 1949, pp. 103-108). This report describes the latest arrangement of equipment.

IN any given formation, the factor which most probably influences drilling speed is the weight on the drilling bit. Through a recently developed equipment setup it is now possible to maintain the bit weight automatically, within very close limits. The maintained weight will not vary appreciably from a desired preset weight, regardless of formation changes and consequent changes in drilling speed.

With a Martin-Decker weight indicator, a Fisher wizard-type pressure regulator, combined with special hydraulic and pneumatic controls, the bit weight will be kept constant even though the bit becomes dulled. Heart of the drilling control is the well-known Brantly hydraulic feed unit of Oil Well Supply Co. Operating from the deadline pull, the drilling unit will help achieve the maximum in rate of penetration and bit life, as well as a straighter hole.

This new hydraulic-pneumatic regulator supplements the manifold of needle valves which has heretofore been used exclusively with the Brantly control. With Brantlys that are not regulator equipped, the rate of feedoff is limited by fixing a rate of fluid flow by adjustment of the needle valves. The fluid in the closed system is caused to flow by a pump which is connected through a series of sprockets and chains to the main drum of the draw works.

Therefore, by setting the needle valves for any given rate of fluid flow through the manifold, the driller could fix the maximum rate at which the drill pipe would be lowered by the Brantly control. Although the maximum rate of descent was thus established, the Brantly alone did not have an automatic control which would prevent slowing the selected rate of descent. This slowing of the drill pipe, if not watched by the driller, might tend to build up bit weight dangerously, particularly in passing from a soft to a harder formation. Nevertheless, this manual control was an improvement over feedoff obtained by hand manipulation of the draw-works brake in the uniform feedoff it gives.



Deadline diaphragm converts deadline pull or tension into proportional pressure against a flexible diaphragm. Fluid system from diaphragm is connected to bourdon tube. As pressure on the system increases due to the "drilling off," the expanding bourdon tube pulls flapper close to orifice block. Air or gas at 25 psi. is connected to orifice block and a small amount of this air continually escapes from orifice. As flapper approaches the orifice, more pressure is diverted to the air relay valve, which in turn supplies greater pressure to bottom of diaphragm in motor valve. This increase in pressure causes the motor valve to open, thereby allowing the hydraulic feed control to "feed-off" at a faster rate, until the predetermined setting is reached.

Principle of Automatic Control

The new regulator for the feedoff control now provides the automatic factor. It tends to maintain any given weight because it will not let bit weight increase past a maximum

value, and will vary the rate of lowering of the drill pipe accordingly. It removes any question of having the drill pipe or bit overstressed. It supplements the manually set needle-valve manifold with a motor valve that is automatically controlled from the deadline.

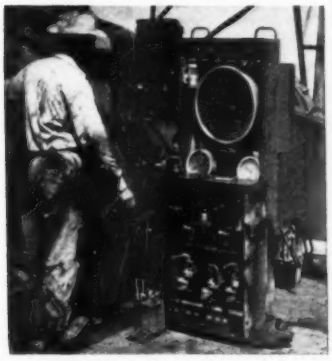
This motor valve is closed by a downward-acting spring above a diaphragm and opened by air pressure beneath the diaphragm. Variation in this air pressure provides a variation in the amount of valve opening.

The air which controls the motor-valve opening is supplied to the pneumatic system at a regulated pressure of 25 psi. The pressure to the motor valve, however, is controlled by letting a part of the supplied air escape from the system through an orifice. The amount of air escaping through the orifice is governed by a flapper-type valve that covers the orifice opening.

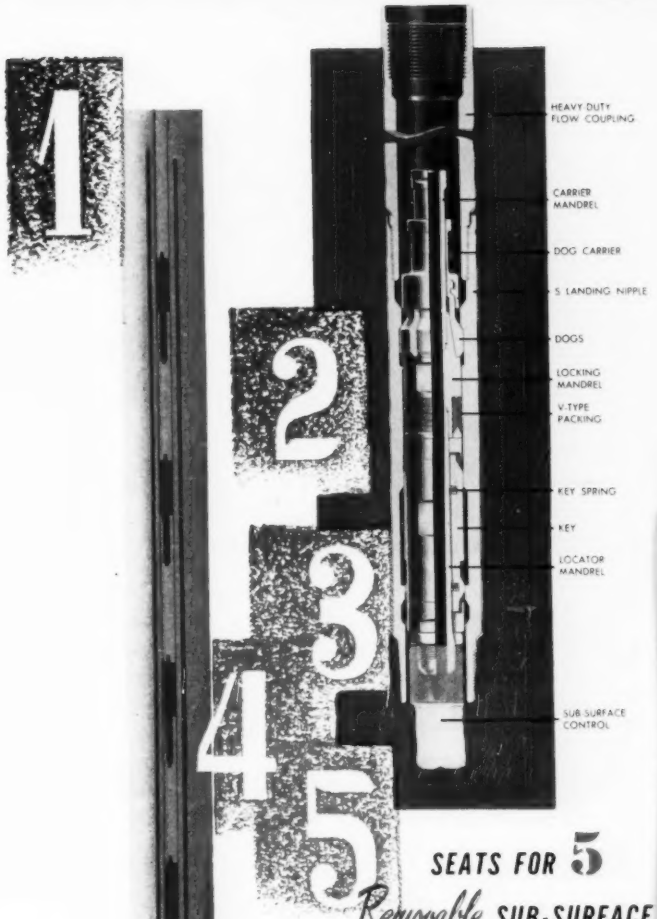
The amount of the orifice opening is controlled through a closed hydraulic system by the amount of pull on the deadline. A weight-indicator-type of clamp, fitted on the deadline, transmits hydraulic pressure to a bourdon tube in amounts that vary with the pull on the deadline. The number of lines up is considered in relation to the bit weight desired and the bourdon tube reflects change in deadline pull either by bending or straightening.

The bourdon tube is connected to the flapper so that when lower deadline pull and higher bit weight result in decreased pressure, the flapper will be pulled away from the orifice, permitting air to escape from the pneumatic system. Escaping air will reduce the pressure in the motor valve, letting it close and restrict fluid flow from the pump. This will slow the rate of descent of the drill pipe, and permit it to drill off to some extent, thereby reducing bit weight to the desired value.

The amount of weight to be carried on the bit is selected by adjusting the



Automatic bit-weight control, on rig of Kuwait Oil Co., drilling deep test DT-1 in Burghan field, Kuwait.



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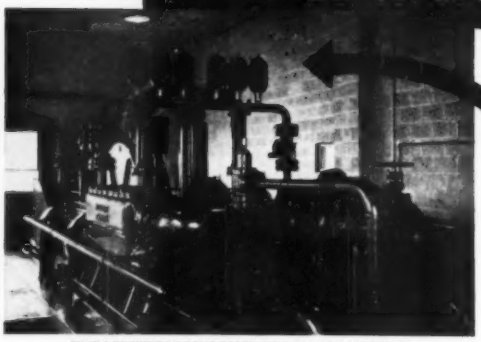

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PRESSURE surges caused by the pulsating action of piston pumps are the most common causes of pipe line and hydraulic system failures. Oil men in all phases of the petroleum industry have been cognizant of the hazards of pump pulsations but have had to live with that which was considered a necessary evil. This, however, is no longer true because an inexpensive GREER Accumulator installed in the discharge line of the pump will greatly minimize pressure surges by absorbing pump pulsations.

Actual tests on a series of ten pumps were recently conducted at the Portland Pipeline Corporation. A Hydrauliscope and camera attachment were used to measure and photograph the pressure surges before and after the installation of GREER Accumulators. The amazing results showed that the accumulators reduced these surges by 53% to 67%.

Our Engineering Department will be happy to demonstrate by similar tests in your own system the effectiveness of GREER Accumulators. Write for additional details using your company letterhead.

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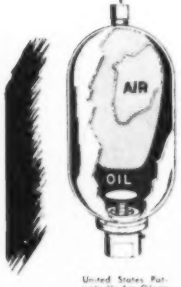

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Exploration Digests

(Continued from page 123)

central and eastern Gulf Coast are divisible into clayey facies and limy facies. The clayey facies, Yazoo, occurs extensively in Louisiana, central and southern Mississippi, and western Alabama. The limy facies, Ocala, is best developed in western Alabama and Florida. Reef facies are present on the Wiggins antincline in southeastern Mississippi.

Surface and subsurface data permit differentiation of four, lithologic, mappable units in the Yazoo group in Mississippi and Alabama. In ascending order these formations are: North Creek clay, Cocoa sand, Pachuta marl, and Shubuta clay. In Louisiana the Yazoo group has been subdivided locally but no mappable formations have been delineated. Westward in Texas, a distinct rock group characterized by sandy facies has been divided into mappable surface units.

The Ocala group presently is undivided in Alabama, but recent workers in Florida have differentiated at least three formations.

Application of International Business Machines to Geological Data

MARGARET A. PARKER, Coal Division, Illinois State Geological Survey, Urbana.

THE use of International Business Machines increases the availability and selectivity of accumulative data and minimizes the amount of paper work and filing space. This technique is especially applicable to handling geological information in large amounts. These machines have been used to organize drill-hole records and the technique employed is offered to show the advantage of this system.

Some Theoretical Aspects of Density Currents

HENRY W. MENARD and J. C. LUDWICK, U. S. Navy Electronics Laboratory, San Diego.

DENSITY currents may be homogeneous or heterogeneous, but all such currents of interest to geologists belong to the latter group because they contain solid sedimentary particles in suspension. It is useful to call them "suspension currents." Suspension currents are characterized by a vertical density gradient. The concept of

(Continued on page 176)

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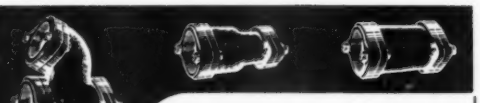

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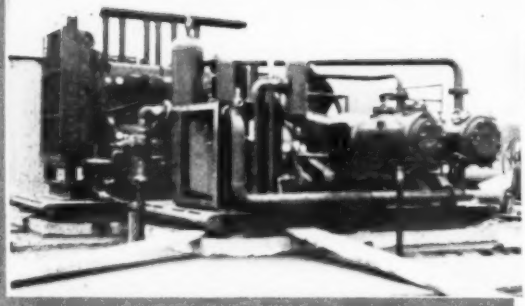

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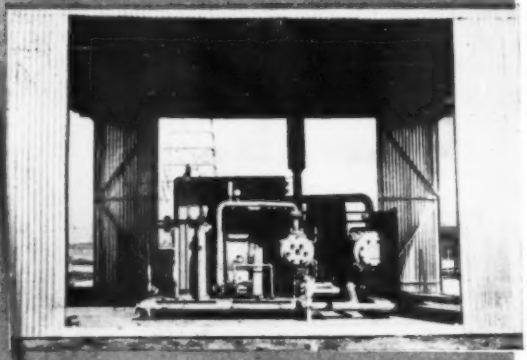

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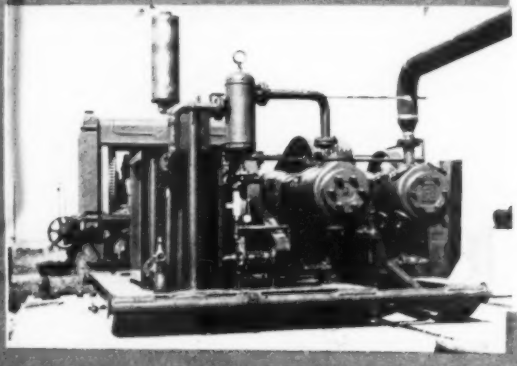

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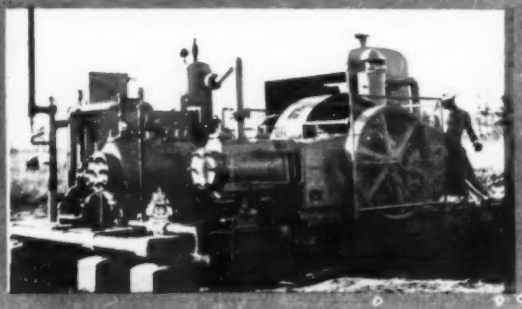

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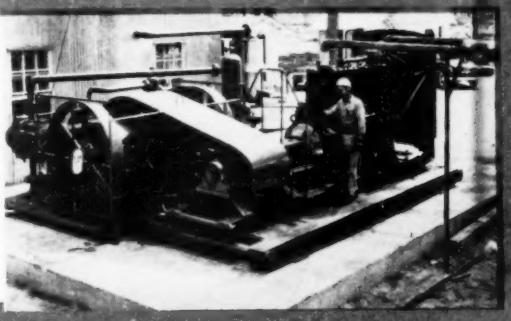

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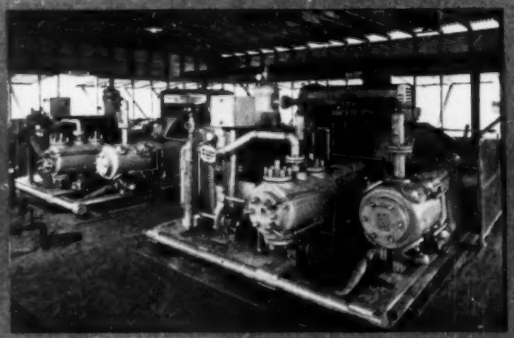

REFUGIO, TEXAS

a density current indicates that suspension currents tend to separate into a fast, thin, dense underflow, and a slow, thick, tenuous overflow because the current is much denser near the bottom than in the overlying part. If a current is eroding, a density gradient must be present. A gradient is increased by the presence of coarse suspended sediment, but because of mixing with the surrounding clear water, a gradient may develop in suspensions containing only mud.

The energy, hence the carrying power, of a suspension current is large compared with the loss of energy caused by friction along the margins of the current. The energy is capable of developing currents which move fast enough to cause erosion, provided they are not first dissipated by turbulent mixing at the interfaces with the surrounding fluid. Pronounced mixing occurs if the velocity of a suspension current exceeds a critical value at which boundary waves develop and grow at the interface. The critical velocity is proportional to the square root of the effective density and the thickness (depth) of the current. An accelerating current must either mix with the surrounding water or become thinner. In the latter instance it is increasingly apt to form boundary waves and to mix, and in either case the acceleration eventually is nullified by mixing. Examples are presented.

Some Quantitative Aspects of Lake Mead Turbidity Currents

HOWARD R. GOULD, University of Southern California, Los Angeles.

A RECENT survey of the sediment accumulated in Lake Mead indicates that slightly more than 2 billion tons of material has been deposited in the lake during the 14-year period from 1935 to 1949. More than 97 per cent of this load had been contributed by the Colorado River, whereas less than 3 per cent has been supplied by the Virgin River.

Approximately 50 per cent of the detrital load supplied by the Colorado has been transported in the form of turbidity currents and deposited on the lake bottom between the point of river discharge and Hoover Dam, a variable distance of 75 to 120 miles. Similarly, an appreciable amount of material from the Virgin has been transplanted by turbidity currents moving through the lake from the present mouth of the river to its former point of coalescence with the Colorado, a distance of 30 miles. Unlike the Colorado turbidity currents, the fine detrital load of the Virgin flows has not been deposited continuously on the lake bottom. The northward extension of the lake with the exception of the delta formed at the mouth of the Virgin is, therefore, an area of sediment bypassing or nondeposition.

Deposition of sediment from the Colorado turbidity currents and the lack of deposition from the Virgin turbidity currents are intimately related to differences in the bottom slope of the two regions. The average slope of the submerged Virgin channel is 13 ft. per mile, whereas that of the submerged channel of the Colorado is only 5 ft. per mile. This relationship may have important applications to the general problem of submarine density currents.

Oil and Gas Possibilities in Post-Frontier Cretaceous Rocks of Wyoming

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J. DAVID LOVE, U. S. Geological Survey, University of Wyoming, Laramie.

THE Frontier formation and older Cretaceous rocks constituting about one-third of the Cretaceous section in Wyoming have yielded approximately 52 per cent of the cumulative oil production and at least 90 per cent of the sweet gas production in Wyoming. The younger two-thirds of the Cretaceous sequence is lithologically similar and has even thicker and more lenticular sandstones, yet has yielded less than 1 per cent of the cumulative oil and gas production in Wyoming. Most of the production from the lower third of the Cretaceous sequence is from structural traps around basin margins where the post-Frontier Cretaceous rocks have been extensively eroded or completely removed. The purpose of this paper is to call attention to the oil and gas possibilities of the upper two-thirds of the Cretaceous sequence within the major basins in Wyoming, where there has been comparatively little exploratory drilling.

The post-Frontier Cretaceous rocks underlie an area of about 53,000 sq. miles in Wyoming, more than half the total area of the state, an area that is comparable in size with Illinois and is considerably larger than Pennsylvania. These rocks have not been studied as thoroughly as the Frontier formation and older strata; but they are characterized by complete facies changes, involving thick sections, in short distances, and an absence of widespread marker beds.

The relative scarcity of information is illustrated by the fact that fewer than 100 published and unpublished complete surface sections, either generalized or detailed, are available for study, and all of these of course relate to the basin margins. Subsurface data, even on partial sections, are available from only about 25 producing areas. Fewer than 50 tests have penetrated the complete post-Frontier Cretaceous section, and most of these are likewise close to the basin margins. Rarely is there one control point for every thousand square miles in the basin.

The paper contains a summary of data available on the post-Frontier Cretaceous

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rocks of Wyoming. It is concluded that, in the search for new oil reserves, the post-Frontier Cretaceous section in the structural basins of Wyoming is well worth investigating.

Sedimentary Features Suggesting Turbidity Flow in Deep Southern California Tertiary Basins

M. L. NATLAND, Richfield Oil Corp., Los Angeles.

THE fauna of the Repetto formation (lower Pliocene) of the Los Angeles and Ventura basins, Southern California, clearly indicates a depositional environment of at least 4,000 ft. of marine water. Yet, the sediments over a large area of these basins contain more than 50 per cent of fine-to-coarse, relatively clean, well-sorted sand, with some beds of conglomerate containing boulders up to 2 ft. in diameter. Most of the sand beds (25 to 500 ft. thick) have thin interbeds of fine silt (1 in. to 5 ft. thick) which contain the same fauna found in thick shale beds above and below the sand, suggesting that the sand beds were not formed by transgressive and regressive phase accompanying a rise and fall of sea level. Currents sufficiently strong to move this coarse sediment are thought not to exist below a water depth of 600 ft. Consequently, some other means—possibly turbidity flow—must be resorted to for a satisfactory explanation of this coarse material in deep water. Examples of sedimentation in these basins are shown, together with kodachrome slides showing turbidity-current generation at the mouths of several Southern California rivers.

Faunal Evidence for Mass Movement of Submarine Sediments

FRED B. PHLEGER, Scripps Institution of Oceanography, La Jolla, Calif.

RECENT work on Foraminifera from submarine cores demonstrates displacement of the enclosing sediments from shallow water into deeper water. This is based on the presence of shallow-water benthonic faunas in various layers in some deep-water cores. The displaced Foraminifera faunas found in such material appear to be of three types: pure shallow-water faunas, mixed shallow and deep-water faunas, and faunas having a lower population than is normal for the area. This evidence suggests the following kinds of submarine transport of sediments: movement as a mass which retains at least a part of its shoal-water features, movement and mixing with deep-water sediments, and transport with differential sorting so that some of the Foraminifera population is segregated from the sediment.

Faunal evidence for displacement of sediment has been studied from three principal areas of the world. Off San Diego, a fauna at present characteristic of water depths less than 900 ft. is found in some cores at depths greater than 2,000 ft. In the northwest Gulf of Mexico faunas now living in depths less than 600 ft., and mostly less than 300 ft., are found in the lower sections of two cores taken at approximately 12,000 ft. Several other cores from the Gulf of Mexico suggest displacement on a smaller scale. The mid-section of a long core from the western Mediterranean, south of Majorca, contains a foreign benthonic fauna characteristic of depths common on the Continental Shelf.

Mass Movement of Sand Into Deep Water

FRANCIS P. SHEPARD, Scripps Institution of Oceanography, La Jolla, Calif.

IT has generally been supposed that sand and gravel formations are indicative of deposition in depths of less than 600 ft. Recently sand layers, containing some gravel, have been cored from depths ranging up to as much as 3,000 fathoms. Most of these layers are interbedded with clays and silts which are normal to the depths existing in the areas. The coarse sediment is particularly common along the axes of submarine canyons, but is found also in basins and troughs. Many sand layers occur in the 3,000-ft. trough off San Diego and sand is also common in the relatively deep basins off the Los Angeles area. One core obtained at a depth of 5,000 ft. in the canyon off Monterey showed a perfect gradation from pebbles at the base to silt at the top, but the sand layers in general do not vary greatly in grain size from top to bottom. Sand layers were reported from the middle of the Gulf of Mexico by a Woods Hole Oceanographic Institution group, and a gravel core was found by the Swedish Albatross expedition in the Romanche Deep of the Atlantic. Ewing and Stetson have reported sand layers in the western Atlantic hundreds of miles from the nearest shore. Other sands were found by Pettersson in the deep parts of the Mediterranean.

It is most difficult to explain how the coarse material could get out into the deep ocean basins, but a possible explanation can be made for the movement of sands into the deep parts of submarine canyons and even out into the troughs and basins off Southern California. Accurate profiles of submarine canyon heads repeated at frequent intervals show clear evidence that the sands and silts which are being deposited rapidly in the shoal parts of these trenches are carried out from time to time, probably as slumps or mud flows which transport the sands for scores of miles down the slopes and out over the floors of the basins, possibly with the help of

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suspension currents. The fact that some of the sand zones found in deep water are more in the nature of lumps than actual layers indicates movement of some kind.

Mesozoic Plant Microfossils and Their Geological Significance

THEODOR JUST, Chicago Natural History Museum, Chicago.

MOST anatomical studies on fossil plants are concerned with stems, leaves, roots, and reproductive organs. However, in recent years, extensive investigations have been carried out on the epidermis (and cuticle) of leaves and cones of gymnosperms and have yielded revolutionary data resulting in refined classifications of the main groups. Numerous sterile specimens can now be definitely referred to their botanical groups. In addition, organically disconnected fossil structures can be assigned to the same plant on the strength of comparative data obtained on living and fossil plants. This great increase in identifiable sterile specimens from many parts of the world provides a new scientific basis for broad stratigraphic comparison and correlation. Moreover, the study and analysis of gymnosperm and other spores and pollen grains, some taken from solid rock, increase immensely the total number of available plant fossils and thus greatly augment the reliability of stratigraphic and climatological conclusions based on them.

Plant Microfossils and Paleozoic Stratigraphy

JAMES M. SCHOPP, Geologist, U.S.G.S. Coal Geology Laboratory, Columbus, Ohio.

THE nature of various kinds of Paleozoic plant microfossils and their useful biocharacters are discussed. These forms commonly occur in gray clastic sediments of continental and near-shore facies; certain types are abundant in some marine deposits. Better known megafossil types are often absent where plant microfossils are abundant; hence plant microfossils offer an additional source of information to aid geologic interpretation. Further study is required to outline stratigraphic ranges in enough detail for general application; purposes of local correlation may be served by attention to assemblages and frequencies of species. Frequency determinations provide a means of close stratigraphic correlation within adjacent areas of deposition, and an empirical index to plant ecologic relationships that probably is unequaled among other types of paleontologic material.

Necessary equipment and the techniques used for studying plant microfossils is suggested with regard to their more extensive practical application. Stratigraphic results of recent studies are reviewed, and the scope and nature of certain studies now in progress are briefly mentioned.

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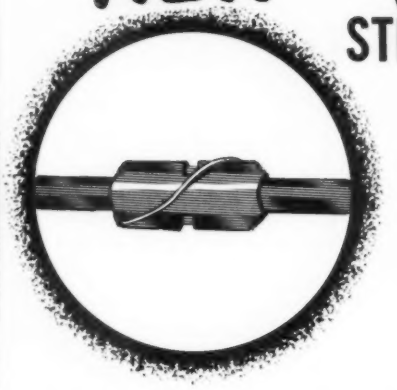

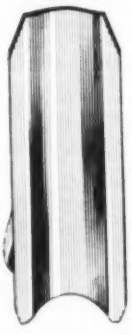

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Paleobotanical Criteria Applicable to Certain Devonian-Mississippian Black Shales

AUREAL T. CROSS, West Virginia Geological Survey and West Virginia University, Morgantown.

THE flora of the black shales of the states athwart the Cincinnati arch are being systematically compared with floras from both similar and dissimilar deposits of comparable age which accumulated in the offshore areas of Appalachia, Llanoria, and Ozarkia.

Age and Environment: A Survey Of North American Tertiary Floras in Relation to Paleoecology

E. S. BARGHOORN, Biological Laboratories, Harvard University, Cambridge, Mass.

APPLICATION of the principle of stratigraphic correlation has demonstrated fundamental units of vegetational change during the geologic history of plant life. Within reasonably elastic limits the evolutionary sequence of terrestrial plant life in geologic time can be effectively translated into a chronological sequence. Vegetational units, expressed in terms of genera and even species, then achieve the status of units of time.

Petrographic Study of Pennsylvanian Sandstones in Murray County, Oklahoma

E. L. LUCAS, University of Oklahoma, Norman.

A RELATIVELY small area of Paleozoic sandstones and shale exposures north of the Arbuckle Mountains in Murray County, Oklahoma, has attracted considerable attention in recent years. These outcropping beds have been referred to as probably representing the Springer formation. The purpose of this paper is to give the results of a detailed mineralogical study mainly of the sandstone members in the hope that the relationship of these beds to the Springer formation in the Ardmore basin, Anadarko basin, and elsewhere in the subsurface might be further established.

These exposures of nearly vertical beds striking about N. 30° E. are viewed through a window in the Pontotoc conglomerate. The measured section of approximately 2,000 ft. consists of four prominent sandstone members separated by thick beds of dark shale.

Sedimentary petrographic studies reveal distinctly similar mineral assemblages of the Springer on the north and south sides

of the Arbuckle Mountains. The mineral suites which contain little or no feldspar imply that the pre-Cambrian granites of the Arbuckle Mountains had not been stripped of the cover of Paleozoic sedimentary rocks by the close of Springer time. They also imply derivation from more than one source and far more likely derived in previous sedimentary cycles from rocks of sedimentary and metamorphic origin.

Occurrence and Lithologic Associations of Evaporites In United States

W. C. KRUMBEIN, Northwestern University, Evanston.

SUBSURFACE and outcrop data on evaporites were compiled on maps showing their geographic distribution in geologic systems within the United States, their associations with other sediments, and their relation to contemporaneous tectonic frameworks. The wealth of data currently available shows that evaporites are more common and widespread than is generally recognized. They are present in all Paleozoic and later systems excepting possibly the Cambrian.

The evaporite occurrences are classifield into four common lithologic associations. These include typical marine sediments above and below the evaporites, transitions from red beds below to normal marine above, transitions from normal marine below to red beds, and associations entirely within red-bed sequences. These associations show that certain evaporite occurrences are typical of intracratonic basins, and others are characteristic of shelf areas.

Permian Basin Third Largest "Oil State"

(Continued from page 130)

Basin platform, and in an area between the north end of that feature and the south flank of the Matador arch. A fairly strong development had gone along on the Eastern shelf in the Glasscock-Howard-Mitchell county area, mostly in the shallower Permian pay zones.

Some oil fields had been found in the Delaware basin to the west of the Central platform, but nothing sensational enough to attract much development and exploration away from other areas that were paying off bigger. This does not condemn the Delaware basin as a place to expect several big oil fields; many smart geologists figure that it has a great future.

During and after World War II, the play for the deeper pre-Permian zones along the Central platform picked up momentum swiftly. Discovery of rich pay zones in these pre-Permian pays caused revival of interest in deep testing of the Midland Black Shale basin. The discovery of multiple pays at Benedum field along the Reagan-Upton county line confirmed again the fact that local highs, even in the deep basin, could and would produce oil fields.

Up to about the spring of 1949, it could have been confidently predicted that deep drilling and development of fields to be found in the Midland Black Shale basin would

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be a dominant feature of the Permian basin play for several years. There was absolutely nothing wrong with the reasoning, and the subsequent history of exploration and its success has been in line with expectations.

But in the spring of 1949, it suddenly became apparent that the Canyon reef discoveries in Scurry County were developing into something of terrific importance. *(See The Oil and Gas Journal, March 10, 1949, page 135.)* What has happened since can be illustrated by some figures taken from Tables 1 and 2. In the entire year of 1949, in the three counties, Scurry, Borden, and Kent, 41 wildcats were completed. In the first quarter of 1950, in these same counties, already 35 wildcats have been completed. The rate of wildcat drilling now is more than triple the 1949 average, yet 1949 was a year in which the area was extremely "hot."

Any area that is getting a wildcat drilling program that extensive is obviously an area where operators are already drilling a lot of oil wells, in producing spots previously found. Again figures from Tables 4 and 5 reveal an interesting story. During the entire year of 1949, operators drilled 295 development wells in the Scurry reef area, and 293 of them were producers. But in the first quarter alone of 1950, they drilled 272 development wells, almost as many in 3 months as in the entire previous year. Incidentally of the 272 wells only 3 failed to produce.

As of January 1, 1950, The Oil and Gas Journal's estimate of proven reserves in the Scurry reef area was 900 million barrels. Developments and extensions or possibly new fields in the general trend have come thick and fast since then. How much additional proven reserve has been added since January 1, 1950? At this stage it is sheer guesswork. There are so many rigs operating extending the various areas already discovered and linking them closer and closer together; there are so many big step-out wildcats finding oil.

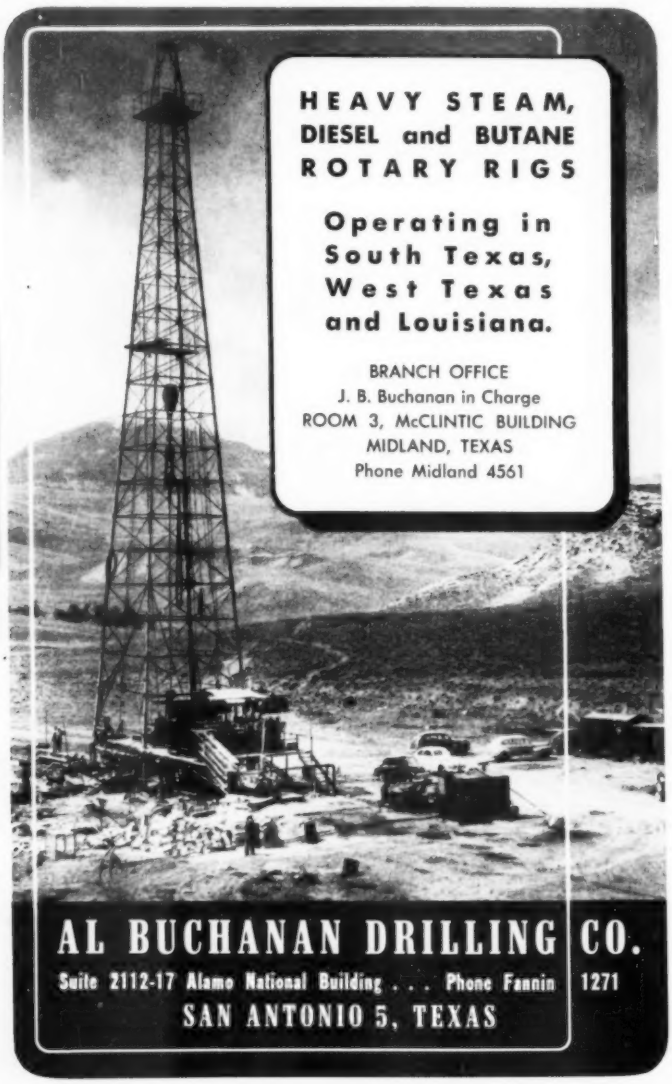
There was a time around the first of the year when it might have been legitimate to question whether the North Snyder area would connect up with the Cogdell area just across the Kent County line. There are very few now who doubt that it will. But as of now, what are you going to say about the 17-mile gap from the Cogdell area on the south line of Kent County to the Young area in Section 166, Block "G"? (See the circle near center of extreme top of map in Fig. 3.)

As of now, one might place the proven reserves at anywhere between a billion and 1½ billion barrels, without running into any serious argument from qualified geologists. With more than 600 wells completed, the fact that such a range of estimates (50 per cent) is possible, is just another indication of how big and how rich an oil accumulation area has been found.

The discovery of this vast field was not an accident, although of course no one dreamed that a giant field was here to be found. In January 1947, one major company completed a dry hole to the Ellenburger between the Kelley and North Snyder areas. That well either just missed the west edge of the field by a half mile or less, or might have made an edge well.

In December 1946, Sun Oil Co. completed the discovery well in Jameson field in Coke County in a Pennsylvanian reef of Strawn age. Subsequent development of that field stirred interest in Pennsylvanian reef possibilities in other parts of the Eastern platform. Geological and geophysical techniques were applied to the search.

The discovery well for the entire area is Sun Oil-Humble Oil & Refining Co. 1 Schattel, completed July 10, 1948. But fate was unkind, the geologists' luck was bad; this well turned out to be on a reef pinnacle and was soon surrounded by four dry holes. Then Magnolia Petroleum Co. found the Kelley area with its 1 Winston, completed November 5, 1948. This well (now known to be an edge producer) pumped 67 bbl. of oil and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28 bbl. of salt water per day on completion. At this stage of development, the whole area might easily have been condemned as "teaser territory," and been shunned for a long time.

But luck finally smiled, and on November 21, 1948, a little over 2 weeks after the Magnolia completion, Standard Oil Co. of Texas 1 Brown-2 found the main part of the reef in North Snyder pool, and flowed 532 bbl. of oil per day through a ¼-in. choke on potential test.

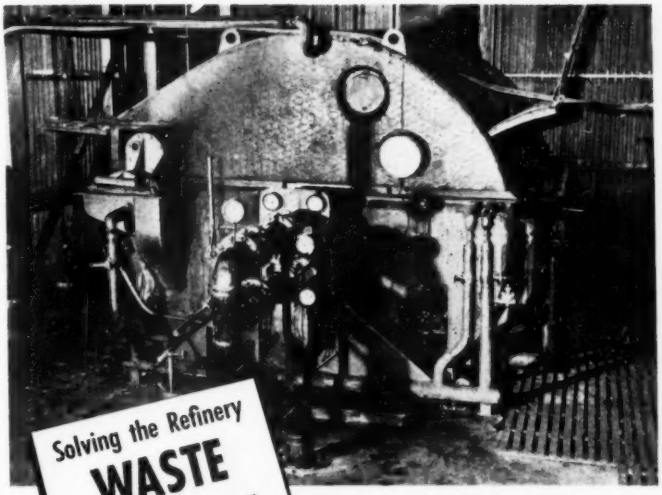
Less than 2 months later, Lion Oil & Refining Co. 2 McLaughlin discovered the main pool at Diamond "M," where as we now know, the reef trend from the north had curved west, leaving the Schattel discovery on an outlier pinnacle. On January 6, 1949, Lion's discovery was completed flowing 649 bbl. daily through a ¼-in. choke on potential test.

After the Lion discovery, a few more geologists began to think some of the early "dreamers" might not have been too visionary after all, when they visualized one long reef field of enormous size. But most of them were still willing to stick to the conservative point of view, and considering the early history, no one can blame them.

Even after the Humble 1 Bishop discovered the reef pay at the northwest end of the old Sharon Ridge Permian pool, formally completing it for a flowing potential of 349 bbl. daily through a ⅜-in. choke March 4, 1949, not too many people recognized the possibilities. Even company geologists who were firmly convinced of the possibilties, found it a formidable task to put recommendations down on paper, based on the probability of a field being 18 miles long and several miles wide, on the strength of the evidence then available. But, as it turned out, those who did were right, in fact were probably conservative.

When all is said and done, however, big as the Scurry reef field is, it is just one more piece of evidence in a long list, that the Permian basin is an exceedingly rich hunting ground for oil fields, and particularly for big oil fields. Table 6, listing major fields, shows that 21 fields in this area are already listed among the major fields of the United States. For concentrated richness of oil accumulations found, probably only the Gulf Coast Tertiary belt of Texas, the eastern Texas area dominated by the East Texas field, and the Los Angeles Tertiary basin of California are comparable.

The prospects for the immediate future, as of today, look far more promising for the Permian basin oil hunters than in any of these other areas. Currently, for instance, developments in the Midland Black Shale basin would be attracting major attention if they were not overshadowed by the Giant Scurry reef play.



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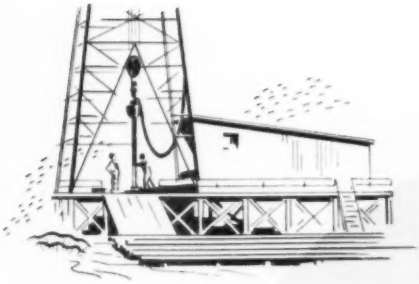

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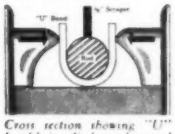
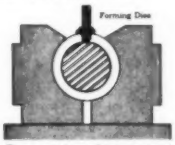


Cross section showing "U" band being die-formed around rod to the scraper blades.



Cross section showing band held under pressure around rod while ends of band are shrink-grip attached to scraper blades. Neither scrapers nor bands are welded to sucker rods.

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West Texas Oil—1950

(Continued from page 136)

the first commercial production in the area in Mitchell County in 1921 until about 1942. The second period extends from 1940 to the present, and on into the future.

The first period covers the intensive and extensive development of oil from pay zones in the upper sections of the Permian limes.

During the second period the pre-Permian and some of the lower Permian pay zones have been tapped and developed. Along with the exploitation of the deeper horizons many new and shallow upper Permian oil fields have been located as indirect results of the deeper drilling.

Until 1942 very little drilling had been done in West Texas below the water level in the San Andres. Of course Ellenburger production had been found in the Big Lake area in southeastern Reagan County in 1928—but that discovery, which was completed for an initial production of 2,600 bbl. of oil per day—did not generate any widespread interest. Many oil-company executives and independent operators felt that it was too deep to be attractive as a commercial proposition.

However, between 1928 and 1942, several other deep pays were found in the south part of the Permian basin. Among the more important were the Simpson and Ellenburger production in the Sand Hills area of Crane County, the Ellenburger production in Apco and Abell fields in North Pecos County, and Ellenburger in Barnhart field, southeastern Reagan County.

Starting in 1942 a number of discoveries were made in various areas of West Texas from the Clear Fork zone of the Permian. Those strikes changed the picture in regard to the previously held ideas of many persons that when water was found in the San Andres there was no use drilling below that zone.

The important event which lighted the fuse setting off the second period of development of the petroleum resources of West Texas was the discovery of prolific production from the Ellenburger in the old shallow Keystone field in central Winkler County. That well was completed during the early part of 1943. Shortly afterwards Ellenburger production was found on the extreme east side of Winkler County to open Wheeler field. These discoveries, coupled with developments in other sectors of West Texas, stimulated an increased interest in the possibilities of the deeper pays of the region. Fullerton field, in northwest Andrews County, in which commercial production was discovered from the Clear Fork of the Permian in March 1942, had spread out by the middle of 1943 to where it was recognized as a major discovery and the most important and extensive Clear Fork field in West Texas.

Both the Ellenburger oil found in Keystone and Wheeler fields in Winkler County and the Clear Fork oil found in Fullerton field in Andrews County was high-gravity, sweet oil. Most of the production from the shallower pays in West Texas had been medium to low-gravity, high-sulfur-content sour crude. In the opinion of this writer the present period of activity and development in West Texas started from the Fullerton, Keystone, and Wheeler discoveries.

Other Important Developments

Following those significant developments, others of equal importance have come at frequent intervals ever since. The first commercial production from the Devonian in West Texas was opened in Crossett field in Southeast Crane County in 1944. In the same year Dollarhide field in southwest Andrews County was discovered. That field was originally open for Ellenburger production. It has since developed oil and gas in commercial amounts from two zones of the lower Permian, the Devonian and the Silurian. The year 1944 also saw the discovery of Levelland field, in Hockley and Cochran counties, as a major producer from the San Andres lime of the Permian.

In 1945 both Devonian and Ellenburger production was found in TXL field in western Ector County. The same field in 1946 developed produc-

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tion from the upper Clear Fork and also from the Wolfcamp, both in lower Permian pays, and in 1947, Silurian production was also found.

The Andector - Ellenburger area along the north line of Ector County and the south lines of Andrews County was opened in 1946. The Yarborough Allen Ellenburger field in southwest Ector was also discovered in 1947.

A very significant discovery in 1946 was Jameson field in northwest Coke County, on the east side of the West Texas Permian basin. That field produced from a Pennsylvanian lime reef. It showed that a formation which had heretofore been held in rather low repute by West Texas oil men would produce oil in commercial amounts.

The year 1948 started off with the completion of the discovery well of Benedum field in central-east Upton County almost at the deep center of the Midland basin. That well was completed from the Ellenburger at a plugged-back depth of 12,011 ft., to make it the deepest producer in West Texas and to show that deep commercial production was to be had in the Midland basin.

Benedum field has now been extended into Reagan County. It has developed production in the Wolfcamp-Permian, the Strawn, and the Bend lime in the Pennsylvanian, in the Fusselman section of the Silurian, and in the Ellenburger.

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During 1948, Pegasus field along the north lines of Upton County and the south line of Midland County was found, although the discovery well was not officially completed until the early part of 1949. The Pegasus discovery was finished with a plugged-back depth of 12,285 ft. in the Ellenburger. It also showed for commercial production from the Pennsylvanian lime, from the basal Devonian, and from the Fusselman section of the Silurian.

Pegasus field has stimulated interest in the deep possibilities of the Midland basin and resulted, at least, indirectly, in the discovery of a new Mississippian field in Southeast Gaines County, and a new field from the Fusselman section of the Silurian in southeast Terry County.

The year 1948 was also highly significant in West Texas oil, because the discovery wells of North Snyder and Kelley fields in Scurry County were completed. The openers of the Diamond M and Sharon Ridge-Canyon fields, also producing from the reef, in Scurry County, were not completed until after the start of 1949.

What the Scurry County Canyon reef discoveries have done to West Texas and to the oil industry of the United States as a whole, is a major story in itself. They have opened a completely new era in the development of the petroleum resources of West Texas.

The foregoing major developments during the last 8 years, together with many other discoveries of almost equal importance, have resulted in current widespread, intensive, and constantly growing drilling and producing program of the region.

Along in 1944 and 1945 many oil men thought that after the flurry and excitement had subsided following a new discovery, things would calm down, and that activity would soon go back to what it had been between 1929 and 1942. However, that hasn't happened at any time since things really got going following the Fullerton, Keystone, and Wheeler discoveries. It keeps increasing, expanding, widening, and enlarging. The number of wells being drilled continues to increase. The potential production of the area continues to increase. The number of fields and the number of producing wells continue to increase. The reserves continue to increase.

Conservative, informed men in the oil business, who were very familiar with West Texas, said 5 years ago that things likely would have to slow down a little while.

Those same men today say that they can see no end to the development program now under way.

West Texas had 25,872 producing oil wells on January 1, 1950—a net increase of 11,576 wells over the 14,296 active producers in the territory on January 1, 1942. During that 8-year

period the total number of producing oil wells in West Texas increased slightly more than 80 per cent.

Daily average production of all oil wells in West Texas during the week which ended May 2, 1942, was 142,050 bbl. Daily average production of all oil wells in West Texas during the week which ended March 18, 1950, was 576,275 bbl.

That comparison does not tell the full story of the increase in the possibilities of West Texas to produce oil in 1950. According to the reports of the oil and gas division of the Railroad Commission of Texas, the maximum efficient rate of production of all the oil wells in West Texas, at the beginning of March 1950, was 1,121,442 bbl. per day.

The region is slated to get a slight increase in allowable during April 1950 which will raise the aggregate allowable of the region to 659,787 bbl. per day. That, however, will be only slightly more than 50 per cent of what the region could produce from its present wells on its maximum efficient rate, if it were called upon to do so.

West Texas had a total of 356 different oil fields on January 1, 1950.

Those fields are scattered throughout the 82,393 sq. miles of territory which is included in the West Texas sector of the Permian basin. That region extends from the north line of Bailey, Lamb, Hale, Floyd, Motley, and Cottle counties, south to the Rio Grande, and it extends west from the east lines of Cottle, King, Stonewall, Scurry, Mitchell, Runnels, Concho, Menard, Kimble, Edwards, and Val Verde counties, to the west lines of Texas.

The West Texas territory covers 31 per cent of the entire state of Texas and it is only exceeded in size by all of Texas, Arizona, California, Colorado, Montana, Nevada, New Mexico, Arizona and Wyoming. It is approximately the same size, in land area, as Idaho and Utah. Each of those two states has about the same area as West Texas.

Informed oil men say the surface has only been scratched in finding all of the possible sources of production which exist in this vast domain.

Scurry Reef Areas

The phenomenal developments in Scurry and adjoining counties in the eastern part of this region during the past 18 months has stimulated interest in the possibilities of finding more production from reefs of Pennsylvanian age in other parts of West Texas.

It is conceded that as the hunt for the reefs goes west across the Permian basin, they will be found at considerably greater depths than those now producing on the east side. But that fact does not seem to scare hunters off, for they are now going through all the activities which lead to more drilling. Whenever there is more drilling, at least in West Texas, more oil is going to be found.

However, the hunt for more reef production is not the only play. Widespread geophysical work has located many subsurface highs in all parts of West Texas, which have not yet been explored. More geophysical prospecting is going forward, and more highs are due to be found.

The development program for 1950 and the programs already mapped for years following 1950 call for widespread wildcatting in all sectors of the West Texas Permian basin. That program includes many shallow ventures and also many prospectors which will go to the Ellenburger.

The Midland basin, the deepest pay section of West Texas, is showing more and more possibilities of multipay fields. The Delaware basin of far West Texas is due to get more attention and more activity. The Central Basin platform from Pecos County, up through Crane, Ward, Ector, Winkler, Andrews, Gaines, and Hockley counties, and acres adjoining those counties will see more exploration, more discoveries and more production — shallow, medium deep, and deep in the next few years.

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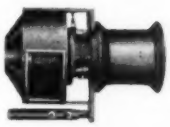

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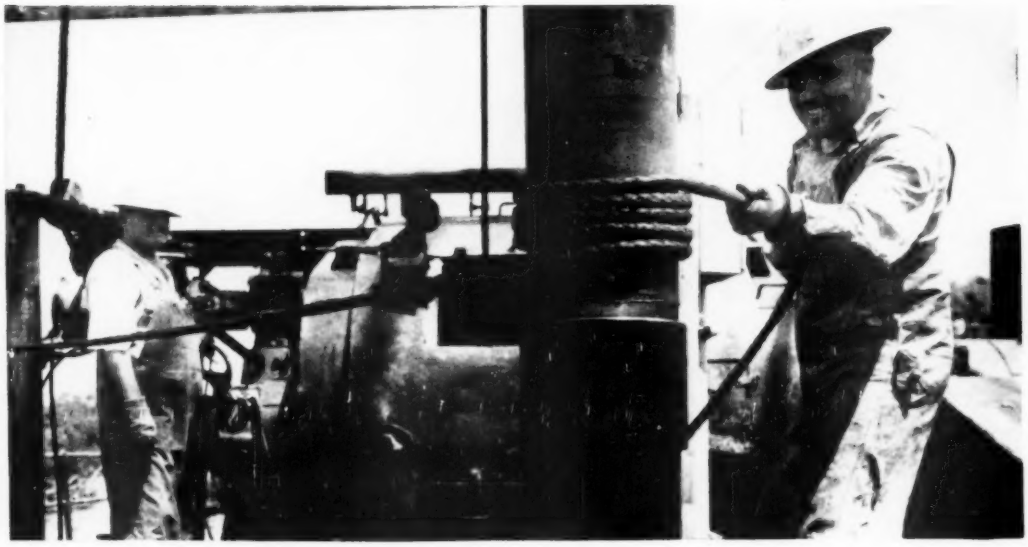

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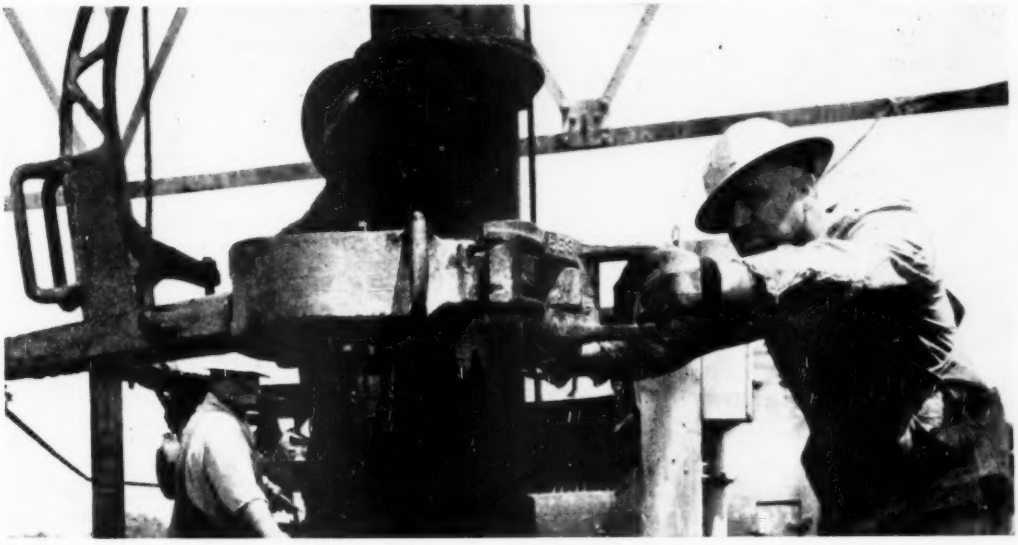

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N.A.C.E. Digests

Important information on corrosion, from papers presented at annual conference, National Association of Corrosion Engineers, Jefferson Hotel, St. Louis, April 4-7.

Water-Side Deterioration of Diesel Engine Cylinder Liners

F. N. SPELLER, corrosion consultant, Pittsburgh, and F. L. LaQUE, in charge of corrosion engineering section, Development and Research Division, International Nickel Co., Inc., New York.

CAVITATION-EROSION is a peculiar complex phenomenon including simple mechanical damage from pounding effects of the collapsing vacuum bubbles plus chemical or electrochemical action of the liquid involved. Either mechanical or corrosion effects predominate depending on the severity of the cavitation effects, as reflected in the time in which the action occurs, the nature of the material, and corrosivity of the environment.

One or more of the following may be expected to provide effective remedies for cavitation erosion as well as ordinary corrosion:

1. Reduce vibration of liners by any practical means, as by redesigning liner supports to introduce dampening effects or avoid establishment of opportunities for resonant vibrations at natural frequencies.

2. Develop and use more resistant liner metal. Hardened alloy cast-iron liners appear to respond better than soft plain cast iron to chromate inhibition of corrosion.

3. Treat water with chromates in proper concentration, e.g., 2,000 p.p.m. or more and adjust pH to proper value, e.g., 8.5 to 9.5. Begin immediately when engine is put in service and maintain thoroughly and continuously. Once started the attack is difficult to arrest. If attack has started, add suitable wetting agent which will not have a reducing effect on the chromate as determined by preliminary studies.

4. Reduce opportunity for vacuum cavities to be developed by:

(a) Keeping water temperature as high as possible.

(b) Keeping water pressure as high as possible.

(c) Introducing air bubbles to serve as cushions against vacuum bubble collapse—as is done with hydraulic turbines. This will of course require simultaneous use of chromate inhibitor.

In addition to cavitation-erosion, there are occasional occurrences of severe crevice corrosion in way of liner supports and especially under rubber gaskets used to seal water passages at bottoms of liners. Protective coating or plastic sealing compound is a likely remedy.

Corrosion Experienced in a New Crude Distillation Unit

D. L. BURNS, Gulf Oil Corp., Port Arthur, Tex.

IN dealing with the corrosive effects of processing low-sulfur-type Ellenburger, West Texas crude with an average of 0.20 sulfur content heated to 500°-700° F. it was found that there is need for more intermediate alloy tubes in distillation equipment. This is especially true where temperature exceeds 550° F.

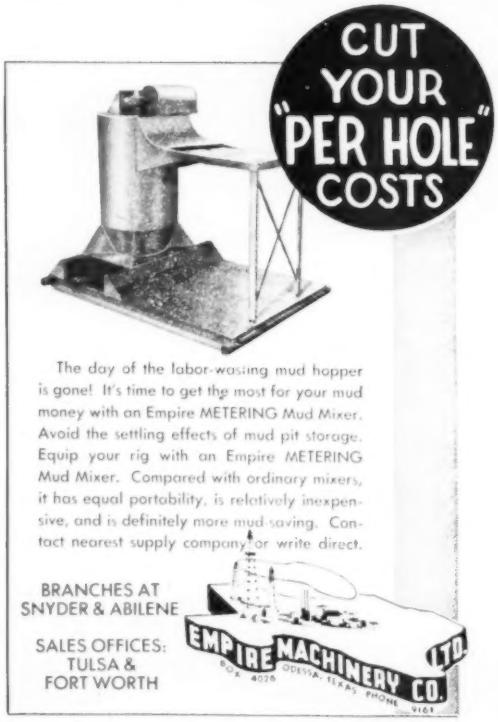
Inspection after several months of operation showed that ammonia treatment had not entirely eliminated corrosion of atmospheric temperature overhead condensers but had reduced it satisfactorily. Excellent condition was observed in the 12 per cent chromium steel strip lining in the flash section of the atmospheric tower as well as in the fabricated alloy trays, and caps in the vacuum tower.

Internal and External Corrosion Experience in Shell's Products Pipe Lines

S. S. SMITH, E. H. RUSH, and W. J. CURRY, Shell Oil Co., New York.

IN 10 years of experience with sodium nitrite inhibition, Shell Oil Co. has increased capacity of products lines and reduced costs through elimination of scraper operation.

The second part of the paper deals with external corrosion. Pilot-plant experiments conducted on Shell's Wood River-Chicago products pipe line produced data indicating that proper field testing and installation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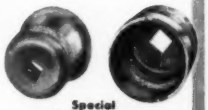

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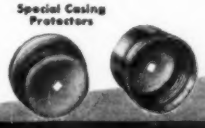

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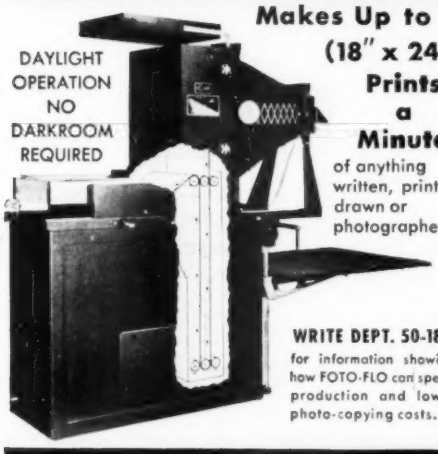

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Left to Right: Clyde Brown, Heard & Silvey Representative; M. M. Lindsey, Owner; J. L. Lindsey, Mechanic

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Shreveport, La.

ATTENTION: Mr. D. G. Silvey

Dear Sir:

I am writing you this letter in reference to Champion Q-X undersurface lubricant. As you know, I am operating two rigs in South Louisiana and have several Waukesha motors on this operation. Prior to using Champion Q-X, we have tried every additive on the market in an effort to eliminate the troubles we were having. I can truthfully say that your Champion Q-X has completely eliminated our ring, valve, and bearing troubles. The oil consumption has been reduced by almost one-half and the engine life has been more than doubled. I feel that we have saved several thousand dollars by the use of Champion Q-X saving overhauls and shutdown time.

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Yours truly,
M. M. LINDSEY DRILLING CO.

M. M. Lindsey
Owner

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Local Rep.—Mr. Harry Lewis.
All American Trading Co., Managua, Nicaragua, C. A.

of magnesium anodes can control destructive corrosion sufficiently to extend the useful life of uncoated pipe to lines to approximately double their unprotected life.

The Wood River-Chicago line, now 26 years old, was 21 years old with a moderately high leak frequency when anode installations were instituted.

Corrosion in Condensate And in High-Pressure Sweet-Oil Wells

R. C. BUCHAN, Humble Oil & Refining Co., Houston.

PROBLEMS of corrosion in condensate and high-pressure wells have certain similarities. In studies of flowing oil wells similar to condensate wells in Louisiana and Mississippi, plastic-coated tubing has proved suitable.

To avoid the type of corrosion encountered at threaded joints, it is suggested that use be made of thread dopes and the application of higher and more uniformly applied torque when making up tubing joints.

Corrosion occurs due to pitting resulting from lack of uniformity in materials and the presence of mill scale. Culling of pipe is advantageous. In some cases it has been necessary to cull as much as 30 per cent before applying baked-on resinous coatings.

N.A.C.E. spool tests on 50 wells of 10 companies showed 9 per cent nickel to be feasible but it will not be widely used until price is reduced. Two strings of galvanized pipe at Bayou Sale, La., gave no better service than black tubing. Nickel-plated tubing is still experimental but wide application seems justified.

Baked-on phenolic-type plastic coatings costing $1 per foot proved economically feasible.

Experience with plastic-coated pipe in condensate wells has not been as satisfactory at oil wells. Still it is justified for some condensate wells.

Soda ash solutions in Katy field, Texas, applied during 4 years has minimized cost of corrosion. Total cost of applications is $50,000 per year or $0.28 per million cubic feet of gas produced. Control of corrosion at Katy is almost complete.

Organic compounds have advantages of better lasting effect than neutralizing agents. If made up in stick form, organic chemicals may be the answer to the problem provided the amount of chemical may be reduced or injection may be reduced to about once a week.

Sodium silicate is currently applied to 200 wells of 20 companies every 2½ to 6 months. Results are difficult to evaluate.

Trouble-free service has been had with well-head assemblies made of 11-13 per cent chromium, 18-8 type, stainless-steel alloys.

Erratic corrosion in flow lines may be protected by chemicals.

In identifying corrosive wells, tests showing iron content less than 40 p.p.m. show corrosion is not important. If iron content is 150 p.p.m. corrosion is important. In the range between 40 and 150 p.p.m. corrosion may be serious unless investigation proves otherwise.

Cathodic Protection of Fourteen Offshore Drilling Platforms

E. P. DOREMUS and G. L. DOREMUS, Cathodic Protection Service, Houston.

CORROSION mitigation is of major importance for drilling platforms. Recent trends have been toward type used in conjunction with floating barge tenders.

Experiments show that corrosion of submerged steel surface, which cannot be protected by coatings for any appreciable length of time, practically can be eliminated by cathodic protection and that such protection also reduced the rate of attack on steel piling in the tidal zone.

Use of high current density polarization in treatment, frequently referred to as the Cox marine electrocating process, can be shown by simple calculation to result in ampere hour savings of 40 per cent during the first year of protection. Present practice is to use a high current density of short duration furnished by magnesium ribbon to deposit a calcareous coating on surfaces to be protected.

Current requirements decrease with time as calcareous coatings continue to build up.

Annual cost of cathodic protection for the initial 2-year installation would be about 6 cents per square foot; expense would subsequently decrease to annual cost of as little as 4 cents per square foot for an extended period.

Surface Preparation Value and Sand Blasting Economics

A. J. LIEBMAN, Dravo Corp., Pittsburgh.

SEMIAUTOMATIC pickup equipment which can recirculate sand to tanks can reduce cost on any sand blasting operation so as to make it economical and acceptable in surface preparation. There are three types of sand blasting: (1) white surface blasting includes complete removal from steel of corrosion products, loose and tight mill scale and gray oxide binder; (2) commercial blasting removes as much as white surface blasting with the exception of gray oxide binder; (3) sand brushoff blasting removes the same materials as commercial blasting and produces an acceptable surface anchor for good paint adhesion and bonding. Steel should be cleaned with a solvent before paint application to a brushoff blasted surface.

(Continued on page 198)

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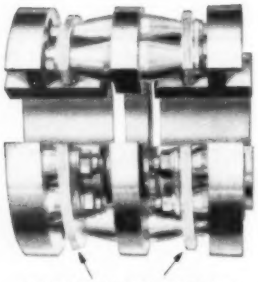

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The SPIRAL design eliminates pipe sticking by cutting a cylindrical path through tight areas and keeping casing out of key seats and away from the wall of the hole.

The SPIRAL design agitates cement in a spiraling motion, slows dehydration and eliminates flash-setting.

It is not generally known, but casing centralizers of the straight type have been available since 1922. Not until the success of the **Spiral Centralizer**, patented in 1937 by J. E. Hall, Sr., were centralizers brought to the fore as good primary cementing tools.

Many centralizing devices have been tried during the past few years; some with complete disregard for actual well-bore conditions. Most have been dropped because of ineffectuality, and a few were only partially successful.

Throughout the years, however, the **Weatherford Spiral Centralizer**, when used according to Weatherford technique, has **proven** to be the only tool that assures perfect primary cementing jobs. As a matter of record, the practicability of the **Spiral Centralizer** has been proven not only by its effectiveness in cementing, but by numerous attempts to duplicate it.

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REFINABILITY OF WEST TEXAS CRUDE OILS

READY-REFERENCE INFORMATION TABLE.—This report presents analyses of crude oils from important West Texas fields. It will provide a means of ready comparison of the properties of crude oils from the different individual pools of the Permian basin. All these analyses were made by the Bureau of Mines routine method which has been used in the same essential particulars for many years.

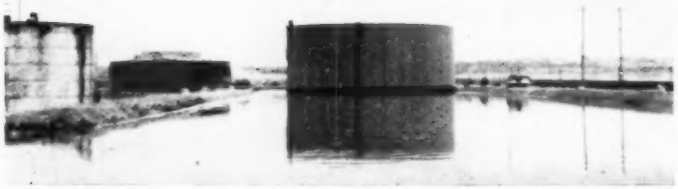
Of particular interest to many at this time will be the "Scurry County Area" data (under that heading in the table) wherein analyses for nine crudes from different producing sectors in that area are given.

By Petroleum Experiment Station, Bureau of Mines, U. S. Department of the Interior, Bartlesville, Okla.

Field and county	Producing formation and age	Depth (ft.)	Properties of crude oil: Gravity °A.P.I.	Color*	Sulfur (%)	Visc. at 100° F. S.S.U.	Carbon residue (%)	Gaso. & naph. (%)	Kerosine (%)	Gas oil (%)	Nonvis. lub. dist.† (%)	Med. lub. dist.‡ (%)	Residuum: Carbon residue Per cent	Residuum: Carbon residue (%)
Abell, Pecos	McKee sand, Simpson form., Ord.	5,353- 5,400	43.4	B.B.	0.21	39	1.6	35.2	18.6	12.1	7.9	4.3	19.9	7.1
Abell, Pecos	Simpson dolo., Simpson form., Ord.	4,740- 5,750	41.7	B.B.	0.34	40	1.6	30.4	21.2	14.0	8.2	3.9	21.2	6.6
Abell, Pecos	Waddell sand, Simpson form., Ord.	5,885- 5,945	40.0	B.B.	0.34	42	1.8	29.3	19.5	11.9	11.8	4.1	23.4	6.8
Abell, Pecos	Ellenburger limestone, Ord.	5,755- 5,882	40.9	B.B.	0.33	42	1.7	30.9	21.9	14.1	8.3	3.3	21.3	6.8
Apco, Pecos	Ellenburger limestone, Ord.	4,554- 4,595	38.6	G.B.	0.27	43	1.9	27.0	12.2	27.1	9.2	5.3	24.5	7.7
Apco-Warner, Pecos	Ellenburger limestone, Ord.	4,450- 4,730	34.2	B.G.	0.77	53	2.6	22.9	11.3	18.7	12.5	5.2	29.3	8.0
Barnhart, Reagan	Ellenburger limestone, Ord.	8,961- 9,082	41.7	N.P.A. 7	<0.10	38	0.4	37.0	18.5	8.8	10.3	5.8	18.9	2.1
Barnhart, Reagan	Ellenburger limestone, Ord.	8,922- 8,986	46.3	N.P.A. 6	<0.10	35	0.3	41.3	10.7	14.2	8.1	6.3	15.4	1.9
Bedford, Andrews	Devonian dolomite	8,757- 9,170	40.6	G.B.	0.57	38	1.5	38.3	10.4	14.2	8.2	5.1	20.5	6.2
Bedford, Andrews	Ellenburger limestone, Ord.	11,018-11,416	43.2	G.B.	<0.10	38	1.5	34.4	19.3	13.0	8.5	4.2	19.7	6.5
Big Lake, Andrews	San Andres, Perm.	3,000	36.4	B.G.	0.36	46	1.2	29.2	10.2	13.7	9.1	6.6	26.8	4.5
Big Lake, Andrews	Ellenburger, limestone, Ord.	8,647	46.3	Green	0.18	36	0.5	41.0	15.0	8.1	9.3	4.3	19.8	2.3
Big Lake, Andrews	Ellenburger limestone, Ord.	3,305- 8,550	41.5	N.P.A. 8	0.14	39	0.7	32.9	17.5	10.1	11.0	5.1	23.3	3.1
Block 31, Crane	Devonian dolomitic limestone	7,850-10,250	44.5	Green	0.18	35	0.7	43.3	10.4	13.1	12.1	3.4	15.2	3.9
Block 31, Crane	Ellenburger limestone, Ord.	10,250-10,440	45.8	B.G.	0.14	36	0.9	36.1	19.3	12.5	12.5		16.8	4.6
Cowden, North, Ector	Grayburg limestone, Perm.	4,265	35.0	G.B.	1.66	42	3.0	33.6	9.3	13.7	8.9	5.8	26.1	11.4
Cowden, South, Ector	Grayburg limestone, Perm.	3,857	33.0	G.B.	1.38	46	2.6	29.3	10.9	14.0	10.2	8.4	26.1	9.8
Crane-Cowden, Crane-Upton	Grayburg-San Andres, Perm.	3,000	32.3	B.B.	2.37	47	3.7	28.2	4.8	20.1	9.2	13.4	23.6	15.7
Crossett, Crane and Upton	Devonian limestone	5,254- 5,374	43.6	N.P.A. 8	<0.10	36	0.5	41.4	17.0	9.2	9.1	5.5	17.3	2.8
Dollarhide, Andrews	Devonian limestone	7,778- 8,051	38.2	B.G.	0.57	41	1.8	35.8	9.8	13.2	8.5	4.9	24.7	6.4
Dune, Crane	Permian limestone	3,190- 3,313	34.4	G.B.	1.49	45	2.4	29.9	10.8	14.7	10.1	8.7	24.9	9.7
Embar, Crane	Ellenburger limestone, Ord.	7,740- 7,901	42.6	Green	0.24	37	0.6	40.2	10.8	14.3	9.6	6.0	18.4	2.9
Embar-Ellenburger, Andrews	Ellenburger limestone, Ord.	7,805- 7,855	44.9	Green	0.18	35	0.6	40.4	9.8	14.9	8.9	6.9	16.7	3.6
Foster, Ector	Permian limestone	4,140- 4,175	36.4	G.B.	1.07	41	7.7	33.3	5.0	19.0	9.5	6.6	24.4	7.7
Foster, Ector	Permian sand and dolomite	4,100- 4,310	35.8	G.B.		40	1.9	32.6	5.1	18.9	9.7	6.0	24.1	7.9
Fuhrman, Andrews	Permian limestone	4,367- 4,476	22.5	B.B.	4.17	110	6.2	14.4	4.1	21.8	11.9	9.4	36.0	17.2
Fullerton, Andrews	Ellenburger limestone, Ord.	6,810- 7,280	43.2	D.G.	0.48	38	1.0	36.0	10.8	14.1	9.2	7.6	18.1	5.3
Fullerton, Andrews	Devonian limestone	8,336- 8,547	41.5	B.G.	0.29	38	0.9	37.5	11.3	14.5	10.6	6.0	19.4	4.3
Fullerton, Andrews	Ellenburger limestone, Ord.	9,880- 9,945	39.0	G.B.	0.47	43	2.9	30.6	17.7	12.5	7.8	4.8	25.4	9.8
Garza, Garza	Permian limestone	2,935- 3,032	36.4	G.B.	0.51	42	2.2	34.5	5.0	18.8	8.9	5.5	23.9	8.2
Goldsmith, Ector	Permian limestone	4,163- 4,179	33.6	B.B.	2.17	49	3.4	26.3	11.3	14.8	11.6	7.8	26.3	11.5
Goldsmith, Ector	San Andres limestone, Perm.	4,175- 4,220	34.2	D.G.	1.90	46	2.5	27.0	11.2	15.6	10.6	8.4	25.0	9.9
Harper, Ector	Permian limestone	4,100- 4,230	36.0	G.B.	1.15	41	2.1	34.1	5.0	19.7	9.6	6.1	25.3	8.3
Hendrick, Winkler	Permian limestone		29.7	B.G.	1.49	59	2.8	22.4	5.4	18.6	8.8	6.3	30.1	9.3
Howard-Glasscock, Howard	Permian limestone	2,880- 2,998	24.0	B.B.	2.76	98	8.3	23.3	3.9	17.9	8.8	5.9	37.8	21.9
Howard-Glasscock, Howard and Glasscock	Permian sand and limestone		29.1	G.B.	1.64	65	3.6	20.7	4.8	20.1	11.4	8.8	32.5	11.2
Iatan-E. Howard, Howard	Permian limestone		32.1	B.B.	1.40	42	3.9	30.4	4.3	19.2	9.0	6.4	29.4	13.2
Iatan-E. Howard, Howard	Iatan limestone, Perm.		30.8	G.B.	1.41	46	3.6	31.3	4.8	18.8	9.3	5.3	28.8	12.6
Jones Ranch, Gaines	Devonian limestone	11,181-11,422	43.8	B.G.	0.19	36	1.2	41.6	10.5	13.7	9.0	5.7	16.4	6.5
Jordan, Crane	Permian limestone	3,407- 3,589	34.6	G.B.	2.13	46	2.9	31.1	4.6	19.4	9.4	7.3	25.0	11.6
Kermit, Winkler	Permian limestone	2,900	28.4	G.B.	1.45	65	3.1	18.1	5.6	22.6	9.7	7.1	30.0	10.2
Kermit, Winkler	Ellenburger limestone, Ord.	10,460-10,705	41.9	N.P.A. 7	0.19	39	0.5	30.0	19.2	13.1	12.0	4.8	20.3	2.3
Keystone, Winkler	Devonian dolomitic limestone	8,040- 8,730	32.7	B.G.	0.69	68	1.9	18.6	8.2	15.6	13.1	9.5	34.5	5.2

Field and county—	Producing formation and age—	Depth (ft.)	Properties of crude oil— Gravity °A.P.I.	Color*	Sulfur (%)	Visc. at 100° F. S.S.U.	Carbon residue (%)	Gaso. & naph. (%)	Kero-sine (%)	Gas oil (%)	Nonvis. lub. dist.† (%)	Med. lub. dist.‡ (%)	Residuum— Per cent	Carbon residue (%)
Keystone, Winkler	Silurian limestone	8,230- 8,507	36.2	B.G.	0.99	49	2.3	31.7	7.9	12.5	8.7	6.1	30.1	6.7
Keystone, Winkler	Ellenburger limestone, Ord.	9,870-10,010	43.8	B.G.	0.18	36	0.6	32.6	17.8	13.0	11.5	5.2	17.3	2.9
Keystone, Winkler	Ellenburger limestone, Ord.	3,400- 3,520	35.2	B.G.	0.84	44	1.8	30.2	5.4	19.2	8.8	5.0	26.1	6.8
Leck, Winkler	Yates-Seven Rivers, Perm.	3,000	29.1	G.B.	1.64	62	2.7	21.6	4.8	19.0	10.2	6.6	31.5	8.5
Levelland, Hockley	Permian limestone	4,725- 4,835	32.7	G.B.	1.90	44	4.1	32.9	4.2	17.9	9.3	7.2	26.5	13.4
Mabee, Andrews	Permian limestone	4,654- 4,700	31.9	G.B.	2.19	47	4.2	30.0	4.2	18.4	9.3	6.7	29.3	12.5
Martin, Andrews	McKee sand, Simpson form., Ord.	8,700- 8,836	41.5	G.B.	0.16	40	2.9	32.5	18.3	13.1	7.1	3.4	23.5	10.7
Martin, Andrews	Ellenburger limestone, Ord.	8,840- 8,880	43.0	G.B.	0.28	38	2.2	34.0	18.2	12.2	7.9	3.4	20.9	8.9
McCamey, Upton	Permian limestone	1,800- 2,300	25.6	G.B.	2.23	105	4.2	15.8	4.0	19.2	10.4	7.7	34.1	12.3
McElroy, Crane and Upton	Grayburg limestone, Perm.	2,815	31.3	G.B.	2.39	50	3.1	27.3	4.4	20.4	10.6	9.7	26.9	11.6
McKee, Crane	McKee sand, Simpson form., Ord.	6,078- 6,098	39.6	B.B.	0.22	44	2.4	26.3	21.3	14.0	9.5	3.8	24.8	8.6
Means, Andrews	San Andres limestone, Perm.	4,500	29.3	B.B.	2.36	62	4.1	22.2	4.4	20.5	11.0	6.9	31.7	12.9
Monahans, Ward	Ellenburger limestone, Ord.	10,081-10,545	47.2	B.G.	0.16	37	0.8	37.7	20.2	11.0	9.3	3.3	15.9	4.4
Nelson, Andrews	Ellenburger limestone, Ord.	10,384-10,606	43.0	D.G.	0.15	38	1.9	32.9	19.4	14.1	7.0	3.8	20.0	8.1
Payton, Pecos	Yates, Perm.	2,040	33.0	G.B.	1.10	48	2.3	25.6	11.5	16.3	11.0	7.6	26.1	8.7
Pecos Valley, Pecos	Yates, Perm.	1,100	34.6	G.B.	1.09	45	1.9	32.4	4.7	20.6	9.9	7.8	24.4	7.8
Pecos Valley, Pecos	Pecos Valley sand, Perm.	1,628- 1,685	29.7	G.B.	1.67	57	3.1	24.8	5.9	19.4	10.0	6.8	29.8	10.3
Penwell, Ector	Permian limestone	3,678	30.8	B.G.	2.59	54	3.5	22.0	5.4	22.4	11.4	8.1	28.5	12.3
Penwell, Ector	Permian limestone	8,888- 9,020	41.7	D.G.	0.24	40	2.1	32.3	19.5	12.7	8.5	3.6	22.0	8.2
Polar, Kent	Permian limestone	7,790- 7,890	40.9	G.B.	0.43	38	2.0	35.1	11.1	12.9	9.6	6.4	20.7	8.4
Sand Hills-Tubb, Crane	Permian limestone	4,137- 4,200	36.0	G.B.	0.92	42	2.2	33.6	10.6	14.9	9.5	6.0	25.0	7.6
Scarborough, Winkler	Yates, Perm.	3,030- 3,090	36.6	B.G.	1.02	42	1.9	34.1	10.6	14.2	10.2	6.8	22.5	8.6
Scurry County and adjacent production:														
Dermott, Scurry	Ellenburger limestone, Ord.	8,200- 8,404	46.3	B.G.	0.17	35	1.3	46.5	9.6	12.6	8.0	4.7	14.5	7.6
Diamond M, Scurry	Canyon Reef limestone, Penn.	6,569- 6,617	45.4	B.G.	0.20	35	0.9	43.0	5.0	17.5	8.5	5.0	16.1	4.9
Kelly, Scurry	Canyon Reef limestone, Penn.	6,773- 6,778	42.1	B.G.	0.22	36	1.1	42.1	5.1	18.9	9.0	5.7	17.2	5.8
Sharon Ridge, Scurry	Canyon Reef limestone, Penn.	6,650- 6,680	45.4	B.G.	0.18	35	0.9	42.2	4.7	18.0	8.2	5.1	15.3	5.1
Snyder, North, Scurry	Strawn limestone, Penn.	7,322	39.8	G.B.	0.23	38	1.8	36.7	10.2	14.9	9.8	5.7	20.9	7.5
Snyder, North, Scurry	Canyon Reef limestone, Penn.	6,260- 6,419	43.4	B.G.	0.22	36	1.0	42.2	5.0	18.3	8.6	6.2	15.1	5.5
Good, Borden	Canyon Reef limestone, Penn.	7,940- 8,010	43.6	B.G.	0.21	36	1.2	42.1	4.8	17.8	8.2	5.3	17.2	6.0
Vealmore, Howard	Canyon Reef limestone, Penn.	7,934- 7,966	43.4	B.G.	<0.10	36	0.8	41.1	10.3	14.3	8.8	4.6	19.0	3.7
Cogdell Lease Sec. 716, Kent	Canyon Reef limestone, Penn.	6,857	41.7	G.B.	0.38	37	1.8	38.2	9.9	14.4	9.0	5.4	19.9	7.6
Seminole, Gaines	Canyon Reef limestone, Penn.	5,084- 5,112	35.6	G.B.	1.76	39	2.5	34.4	4.8	19.4	9.5	6.7	23.4	10.5
Shipley-Silurian, Ward	Silurian limestone	7,010- 7,075	30.6	B.G.	0.29	115	2.4	7.7	11.4	10.8	17.8	4.0	46.6	5.2
Slaughter, Hockley	Permian limestone	2,973	32.3	G.B.	1.93	45	3.5	32.0	4.5	19.1	9.2	6.9	27.3	13.0
Slaughter, Hockley	Permian limestone		32.3	B.B.	2.07	48	3.7	32.4	4.2	19.7	9.1	6.0	27.9	13.1
Snyder, Howard	Permian limestone	2,710	29.9	G.B.	1.68	48	4.7	29.0	4.5	19.3	9.0	7.8	28.9	16.2
Taylor-Link, Pecos	San Andres limestone, Perm.	1,613- 1,625	30.2	G.B.	1.32	62	2.5	20.9	5.3	19.5	10.4	6.6	31.7	7.8
Three Bar, Andrews	Devonian limestone	8,300- 8,385	39.4	B.G.	0.61	39	1.7	36.2	9.9	13.6	8.6	6.4	23.3	6.4
Tobarg, Andrews	Tobarg sand, Cret.	430	25.7	G.B.	1.95	95	4.1	17.9		22.6	8.9	4.1	36.2	11.3
Todd (Deep), Crockett	Strawn limestone, Penn.	5,691	40.0	B.G.	0.15	39	0.7	33.5	10.1	15.2	10.9	6.7	22.3	3.0
Todd (Deep), Crockett	Ellenburger limestone, Ord.	5,800- 6,330	41.3	N.P.A. 8	0.32	38	0.8	36.2	10.5	13.6	10.2	6.3	20.8	3.4
TXL, Ector	Devonian dolomitic limestone	7,886- 8,020	38.6	B.G.	0.50	41	1.6	32.8	9.7	13.7	9.2	6.4	23.5	6.0
TXL, Ector	Ellenburger limestone, Ord.	9,563- 9,793	44.1	B.G.	0.19	37	1.1	33.7	18.3	13.0	8.7	3.7	20.4	4.8
TXL, Ector	Ellenburger limestone, Ord.	10,790-10,975	40.9	G.B.	0.19	38	2.2	31.0	19.7	14.0	9.3	5.3	20.6	9.1
Waddell, Crane	Ellenburger limestone, Ord.	5,939- 6,014	44.7	G.B.	0.22	37	1.3	34.8	20.1	12.4	8.4	3.9	18.4	6.8
Ward, Ward	Permian limestone	3,000	35.0	G.B.	1.77	41	3.0	33.6	9.1	14.7	8.6	5.6	22.2	13.3
Ward, North, Ward	Permian dolomitic sand	2,600	35.2	G.B.	1.21	43	2.1	32.2	10.5	13.9	9.2	5.9	24.6	8.5
Ward, South, Ward	Permian sandstone	2,532	37.2	B.B.	1.27	42	2.2	32.4	4.7	18.4	8.6	5.0	24.0	9.2
Wasson, Yoakum	Permian limestone	5,080- 5,276	34.2	B.G.	1.90	44	1.5	32.6	9.1	14.2	8.8	6.6	26.2	5.6
Wasson, Yoakum and Gaines	San Andres dolomite, Perm.	7,055- 7,433	34.6	G.B.	1.63	41	2.8	35.0	4.4	18.1	9.1	4.8	23.6	2.4
Wasson, Gaines	"Wasson 72" dolo. ls., Perm.	7,055- 7,433	35.2	G.B.	0.99	38	2.6	37.8	4.5	18.7	9.5	6.2	21.4	12.1
Wasson, Gaines	Clear Fork limestone, Perm.	6,210- 6,881	32.8	G.B.	1.41	41	3.4	35.5	4.6	17.9	9.2	6.6	24.3	13.9
Wasson, Yoakum	Permian limestone	4,950- 5,150	32.8	B.B.	1.85	44	3.8	33.3	4.2	18.7	9.9	5.9	27.5	12.0
Welch, Dawson	Permian limestone	4,830- 4,935	32.3	G.B.	2.14	45	3.6	31.7	4.9	19.0	10.0	6.4	27.0	11.7
Wentz, Pecos	Ellenburger limestone, Ord.	4,327- 4,440	34.4	G.B.	0.63	55	2.4	24.4	10.0	15.6	10.3	7.0	32.1	6.7
Westbrook, Mitchell	Ellenburger limestone, Ord.	3,050	22.3	B.B.	3.92	79	8.0	25.6	3.5	17.4	8.8	6.1	33.9	23.6
Wheat, Loving	Delaware Mountain, Perm.	4,221- 4,270	38.0		0.21	42	0.8	29.5	17.9	10.0	10.8	7.0	23.8	3.5
Wheeler, Winkler	Devonian dolomitic limestone	8,347- 8,520	44.5	B.G.	0.19	36	1.1	36.6	19.9	11.5	8.3	4.0	18.2	3.2
Wheeler, Winkler	Ellenburger limestone, Ord.	10,559-10,601	40.4	D.G.	0.31	42	2.2	30.3	18.9	12.9	10.0	3.3	24.3	8.0
World, Crockett	Grayburg limestone, Perm.	2,644- 2,647	29.1	G.B.	0.73	105	2.8	14.2	4.0	17.7	10.6	7.7	41.3	6.8
Yates, Pecos	Permian limestone		29.1	D.G.	1.59	64	3.3	22.6		23.7	8.8	6.0	33.5	9.8
Yates, Pecos	Permian limestone	1,655- 1,844	22.1	B.B.	2.79	175	5.8	13.2		19.5	8.9	5.8	50.4	10.7

*Colors of crude oils in this table are designated as follows: Green, no abbreviation; dark green, D.G.; brownish green, B.G.; greenish black, G.B.; brownish black, B.B.; N.P.A. numbers. †S.U. viscosity range at 50-100 sec. ‡S.U. viscosity range at 100-200 sec.



California Refining Co.'s 96,000-bbl. tank being floated down water-flooded artificial basin to new location (Perth Amboy, N. J., refinery).

96,000-Bbl. Oil-Storage Tank Moved to New Location

FACED with relocating a 96,000-bbl. oil-storage tank, engineers of California Refining Co., Perth Amboy, N. J., and Utility Construction Co., New Brunswick, N. J., took advantage of an available salt-water supply to float the tank at very low cost.

The welded plate tank was 120 ft. in diameter, 48 ft. high, and weighed 324 tons. It rested on a concrete perimeter foundation at elevation 8.85 m.s.l. The problem was to place the tank on a new foundation at elevation 14.75 m.s.l. a distance of 1,070 ft. away.

The new foundation consisted of a 6-ft. compacted gravel fill resting on clay and topped with a 3-in. thick bituminous concrete surface. The paved surface had a 9-in. conical crown. Foundation was 18 in. higher than the surrounding ground.

Before the basin construction could be started it was necessary to extend a 30-in. storm drain. Then an 8-in. discharge line with a gate valve was installed so that the basin could be slowly emptied of water after the tank had been moved, without flooding the surrounding area.

"Bathtub" basin used.—The basin itself consisted of a dike built in the shape of an old-fashioned bathtub with the tank being at one rounded end and the new foundation at the other. The dike was built up to elevation 19.0 m.s.l. or 1 ft. above the estimated necessary water level. The dike was 10 ft. high in the immediate vicinity of the original location of the tank and averaged 6 ft. elsewhere. Because of the porous sandy soil, an 8-in. layer of clay was placed along the bottom to seal it.

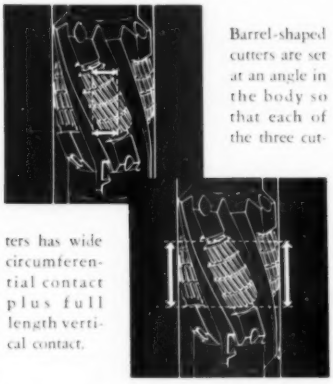
Salt-water float.—Problem of obtaining 9,000,000 gal. of water was not difficult; it was available in an adjacent process storage pond. Two gasoline-driven centrifugal pumps (combined capacity 290,000 g.p.m) were used for the transfer.

To prepare the tank for moving, three towing lugs were welded to the tank 3 ft. from the bottom, spaced 90° at the future east, north and west points at the new location. At the same time four anchoring eye-bolts were welded at the same height between the towing lugs so that there

These two pump units transferred the 9,000,000 gal. water "skidway," from an adjacent process storage pond.

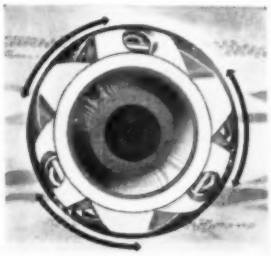
Special Security Reamer for Drill String Stabilization

A new Reamer-Stabilizer especially designed for West Texas fields has been recently developed by Security Engineering Co., Inc. Run between drill collars, this rugged tool eliminates drill stem whip and rock bit gyration or walking, while producing clean, full gage hole.



Barrel-shaped cutters are set at an angle in the body so that each of the three cutters has wide circumferential contact plus full length vertical contact.

When this tool is run, more weight can be applied to the bit to make hole faster because the Security Reamer-Stabilizer acts as a large roller bearing. Full barrel-shaped cutters provide more than enough side wall bearing surface to insure perfect drill string stabilization.



Top view of the reamer body indicates the ruggedness of the tool that permits continuous drill string stabilization under the most severe drilling conditions. Note how cutters contact the formation along an arc of the circle representing the full gage hole, insuring a "bearing-like" action combined with efficient shearing, cleaning action.

Security

ONE OF THE DRESSER INDUSTRIES

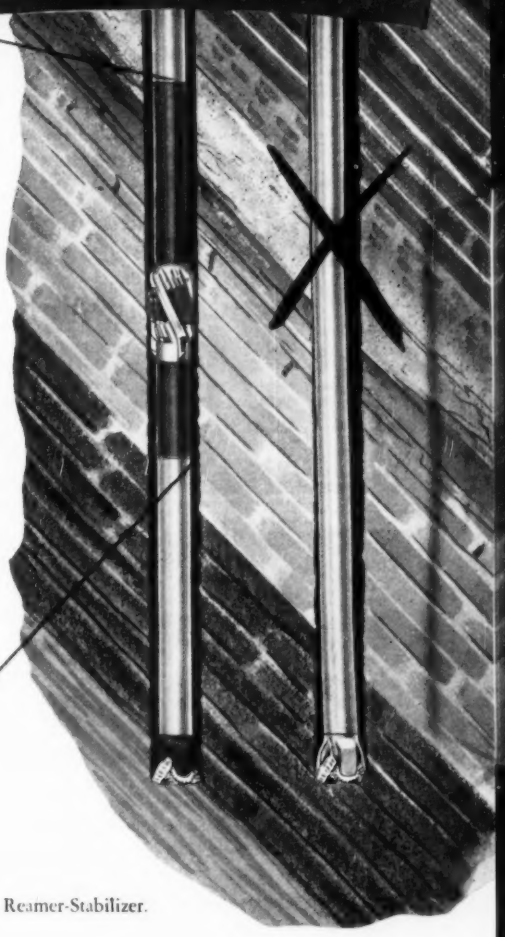
Stabilize YOUR DRILL STRING

WITH THE SECURITY REAMER-STABILIZER

- **INCREASE DRILLING WEIGHTS**
- **ELIMINATE DRILL PIPE WHIP**
- **MAKE FULL GAGE HOLE**
- **ELIMINATE BIT WOBBLE**

When the new Security Reamer-Stabilizer is run between drill collars, it not only insures clean full gage hole, but provides unexcelled drill string stabilization. With three barrel-shaped cutters contacting over a third of the wall circumference at all times, this new tool acts as a large roller bearing, absorbing and transmitting to the formation all forces tending to start drill stem whip and rock bit gyration.

The result of running the Security Reamer-Stabilizer is a smooth drilling string to which weight may be added *without* the usual undesirable effects. Drilling can proceed at a faster rate and the time for the entire drilling operation is reduced appreciably.



LOOK AT THESE FEATURES

- Extra strong body sections throughout.
- Barrel-shaped cutters provide proper bearing surfaces for efficient stabilization.
- Forged steel body heat treated for maximum strength and toughness.
- Cutters retained in body by exclusive locking device.
- Extra long upper shank for easy handling

Ask your Security Field Representative about the Reamer-Stabilizer.

Security

HOLE OPENER

ROCK BITS • CORING BITS • REAMERS • CASING SCRAPERS • SECURALOY

SECURITY ENGINEERING CO., INC.

ONE OF THE DRESSER INDUSTRIES

Main Office: Whittier, California
Branches in all major producing areas.
Export Office: Chanin Building, New York City

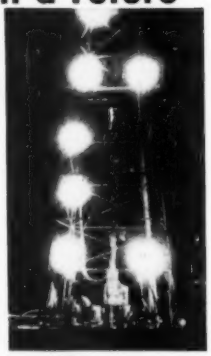
would be an anchor every 30° completing the semicircle.

Cables were attached to the two outside towing lugs and connected to two bulldozers equipped with power winches, spaced 200 ft. from the tank and on top of the dike. When the water level reached elevation 17.0 m.s.l., the winches went into operation. The tank was moved in five 200-ft. steps, and after each step the cables were let out and the bulldozers moved ahead 200 ft. As the tank moved the pumps continued to fill the basin and by the time the tank reached the new foundation the water level was sufficient to go over it.

In place.—Before filling the basin seven anchor posts spaced every 30° in a semicircle had been placed 6 ft. into the ground. These posts consisted of sections of old telegraph poles and were braced with old railroad ties placed horizontally and imbedded into the dike. At the new site, the tank was anchored into position with turnbuckles connected to those posts and to the previously mentioned towing lugs and eye-bolts. The tank was pulled to exact position upon directions given by utility engineers who had transits set up due south and due west and were sighting upon corresponding marks on the tank. When the tank was anchored into place, the gate valve was opened and the water allowed to run out.

® String-a-lite

Portable Lighting With a Future



To simplify installation and provide maximum portability, MINES String-a-lite lines are sectionalized. Each section interconnecting through Push-Latch (B) end plugs to form the complete light string. Factory molded of oil resistant Neoprene, Push-Latch Connectors are vulcanized as a unit into rubber covered cable. They have hook-type metal couplings that connect easily yet cannot become accidentally disengaged. When connected, water, dirt and oil is automatically sealed out. This insures a long-life of positive contact. String-a-lite lines are 100% salvable (i. e.) can be used repeatedly. Choice of Vapor-Proof (A) or Weather-Proof (C and D) correctly spaced, light outlets in packaged assemblies to fit any rig.

Check these Worthwhile Advantages

Packaged in Weather-Proof and Vapor-Proof Rig or Derrick assemblies. Sectionalized in easy to handle lengths, through Push-Latch Connectors. Supplied with floodlights for illuminating the working floor and other areas. Installs easily, dismantles simply . . . allows quick replacements or additions. Available with or without circuit breaker protection for light-strings. Maximally resistant to aging, ozone, moisture, oil, acid and vibration. Cable Connector combinations available for auxiliary power extensions.

Consult a Joy Engineer

Insist on *String-a-lite* the original portable lighting string.

MINES EQUIPMENT — MINES — Division

JOY MANUFACTURING COMPANY

HENRY W. OLIVER BLDG., PITTSBURGH 22, PENNA.

N.A.C.E. Digests

(Continued from page 192)

A comparison of the three methods under the same operating conditions shows that the production per machine hour for the white surface method is 75 to 140 sq. ft., for the commercial method 275 to 400 sq. ft., and for the sand brushoff method, 650 to 1,000 sq. ft.

Sand blasting costs range from 5 to 40 cents per square foot. Costs may frequently be reduced by correct selection of the type of sand blasting which would be adequate for the results required.

Surface Potential Method of Corrosion Survey on Pipe Lines

O. W. WADE, Great Lakes Pipe Line Co., Independence, Kans.

THE surface-potential method of corrosion survey may be easily taught to field personnel. Equipment required for a crew, including a technician and two helpers, consists of the following: (1) Two copper sulfate half cells; (2) 100 ft. of test lead wire; (3) pipe-locating rod; (4) pipe-contact rod; (5) electronic pipe locator.

A crew of three men can cover 2 to 3 miles in 8 hours. Great Lakes Pipe Line Co. has surveyed by this method over 100 miles in different locations. Line currents were recorded (millivolt drop across 100 ft. of line); soil resistivity every 50 ft.; surface potential every 100 ft., and actual pipe to soil potential (Cu-Cu-So$_4$ reference) every 500-600 ft.

The surface-potential method proved to be extremely accurate in determining location of previous leaks.

Study of data revealed that the prime consideration for the location of anodic areas was the pipe-to-soil potential calculated from surface potential observations.

Surface potentials are useful in determining extent of external corrosion prevailing on existing bare pipe lines. Data may be used for finding: (1) exact amount of pipe footage to be reconditioned, (2) optimum locations for installing expendible anodes on coated lines, and (3) location of imperfections in protective coatings.

Performance of Magnesium Galvanic Anodes in Underground Service

HAROLD A. ROBINSON, Midland, Mich., and OLIVER OSBORN, Freeport, Tex., Dow Chemical Co.

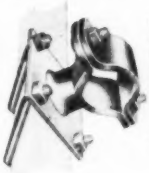
PERFORMANCE of magnesium galvanic anodes in various backfills and in several different soils has been studied in tests of 1 to 4 years' duration at two widely separated test sites. Anode performance is found to be affected by several variables, notably anode composition, time, backfill composition, current density, and soil characteristics.

Field tests show that both anode efficiency and uniformity of corrosion attack improve with increasing current density as previously indicated by laboratory data. Potential measurements made with the Pearson-Hadley null circuit show magnesium anodes to become more anodic with increasing current density.

Excellent maintenance of current flow is observed over periods of 3 to 5 years on large groups of anodes. For individual anodes the most stable current flows are associated with deep installations and poor to fair soil drainage. In chloride-rich soils, anode current output tends to rise with time. Poor current maintenance is associated with installations in sandy, well-drained soils, especially on slopes or elevations.

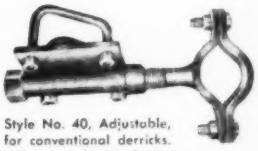
DRILLING EQUIPMENT MFG. CO.
DEMCO
OKLAHOMA CITY, OKLA. U.S.A.

STANDPIPE CLAMPS



are tops for either conventional or mast type derricks. You'll like their rugged construction and ease of installation.

RIGID TYPE—Bolts around derrick leg. Standpipe may be left mounted on leg, even when moving. Types available for either angle or round leg masts, and for 3" or 4" standpipe. 4 sections per set.



Style No. 40, Adjustable, for conventional derricks. Bolts around girt. 3 sections per set, 17", 21" and 28", all adjustable to regulate distance of standpipe from leg.

Always specify type and size of derrick and size of standpipe.

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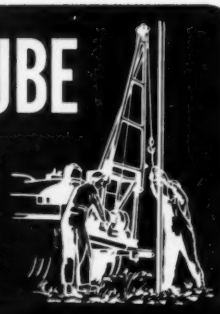

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QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Note: This is a continuation of the question of March 9, 1950. The characteristics of paraffin-base crude oils and stocks were discussed in that answer.

NAPHTHENIC CRUDE OILS OF THE UNITED STATES*

Field and state—	A.P.I. gr.	S (%)	Gaso. & naph. (%)†	Wax	Characterization factor‡
Naphthene Base					
Aliso Canyon, Calif.	24.2	0.67	13.7	Trace	11.36 & 11.36
Belridge, South, Calif.	23.8	0.86	23.8	Absent	11.14 & 11.18
Brea-Olinda, Calif.	12.3	2.99	6.6	Absent	11.16 & 11.05
Buena Vista Hills, Calif.	26.8	0.59	26.9	Absent	11.42 & 11.36
Coalinga, West, Calif.	15.4	0.71	2.2	Absent	11.28 & 11.18
Edison, Calif.	15.9	0.68		Absent	11.36 & 11.22
Elk Hills, Calif.	23.1	0.69	13.1	Absent	11.29 & 11.33
Inglewood, Calif.	21.0	1.84	12.9	Present	11.39 & 11.42
Kern Front, Calif.	15.1	0.89		Absent	& 11.19
Kern River, Calif.	14.1	1.07		Absent	11.23 & 11.16
Kern River, Calif.	10.7	1.23			& 11.12
Lost Hills, Calif.	18.4	0.99	7.6	Absent	11.15 & 11.10
Midway-Sunset, Calif.	20.3	0.88	10.5	Absent	11.15 & 11.10
Mount Poso, Calif.	16.8	0.65		Absent	11.36 & 11.30
Newport, Calif.	12.3	1.99		Absent	& 10.93
Round Mountain, Calif.	22.5	0.43	7.4	Absent	11.26 & 11.34
Santa Maria-Orcutt, Calif.	23.0	2.63	21.8	Present	11.46 & 11.38
Torrance, Calif.	13.8	3.29		Absent	11.33 & 11.29
Wilmington, Calif.	25.6	1.24	20.4	Present	11.48 & 11.39
Iberia, La.	23.5	0.21	2.5	Absent	11.22 & 11.42
Govt. Wells, North, Tex.	24.3	0.16	3.6	Absent	11.16 & 11.22
Greta, Tex.	25.9	0.22	7.6	Absent	11.23 & 11.22
Heyser, Tex.	37.0	0.13	39.7	Absent	11.35 & 11.20
Hoffman, Tex.	26.8	0.14	10.0	Absent	11.20 & 11.24
Lolita, Tex.	33.8	0.15	24.5	Present	11.49 & 11.34
Loma Novia, Tex.	23.5	0.10		Absent	11.00 & 11.06
McFaddin (Greta sand), Tex.	21.8	0.28		Absent	11.15 & 11.14
Midway, Tex.	34.8	0.12	33.8	Present	11.37 & 11.09
Placedo, Tex.	25.2	0.14	2.4	Absent	11.22 & 11.18
Refugio, Tex.	34.8	0.12	35.0	Present	11.40 & 11.20
Refugio, Tex.	24.0	0.14	1.1	Absent	11.12 & 11.16
Saxet (shallow), Tex.	26.3	0.15	2.8	Absent	11.29 & 11.28
Seven Sisters, Tex.	22.1	0.13		Absent	11.09 & 11.05
South Houston, Tex.	25.0	0.20	9.9	Present	11.06 & 11.38
Tom O'Connor, Tex.	34.2	0.21	30.0	Present	11.38 & 11.29
Van (shallow), Tex.	20.3	1.42		Absent	11.37 & 11.54
West Ranch, Tex.	30.0	0.13	20.0	Absent	11.26 & 11.26
White Point, East, Tex.	38.6	0.10	39.9	Present	11.40 & 11.16
Naphthene Intermediate					
Smackover, Ark.	20.5	2.30	9.1	Absent	11.40 & 11.47
Smackover (Norphlet), Ark.	19.8	2.36	7.0	Absent	11.35 & 11.46
Capitan, Calif.	22.0	0.69	9.7	Present	11.45 & 11.54
Fruitvale, Calif.	24.2	0.60	10.1	Present	11.38 & 11.68
Lost Hills, Calif.	29.5	0.66	31.5	Absent	11.49 & 11.56
Richfield, Calif.	22.3	1.09	14.7	Present	11.49 & 11.55
Anse la Butte, La.	22.8	0.17		Absent	11.14 & 11.46
Gueydan, La.	27.7	0.17	5.0	Absent	11.29 & 11.76
Vinton, La.	32.5	0.19	22.5	Present	11.46 & 11.62
Amelia, Tex.	30.0	0.20	17.9	Absent	11.40 & 11.60
Clear Lake, Tex.	27.1	0.17	9.8	Present	11.29 & 11.52
Conroe, Tex.	37.8	0.12	36.4	Present	11.46 & 12.01
Fannett, Tex.	31.1	0.21	16.5	Present	11.40 & 11.70
Hastings, Tex.	31.3	0.24	19.4	Present	11.42 & 11.60
Hendrick, Tex.	29.7	1.49	22.4	Absent	11.49 & 11.49
High Island, Tex.	26.6	0.26	11.0	Absent	11.31 & 11.52
Manvel, Tex.	26.8	0.19	3.1	Absent	11.26 & 11.66
Raccoon Bend (Deep), Tex.	31.1	0.10	16.2	Present	11.26 & 11.96

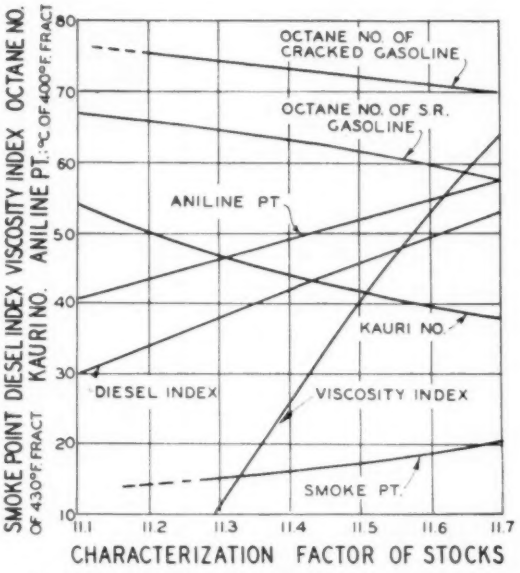

Fig. 1—Approximate properties of stocks from naphthenic crudes.

Field and state—	A.P.I. gr.	S (%)	Gaso. & naph. (%)†	Wax	Characterization factor‡
Sugarland, Tex.	28.6	0.30	16.0	Absent	11.22 & 11.54
Thompson, Tex.	26.1	0.20	8.0	Absent	11.24 & 11.52
Webster (Friendswood), Tex.	29.3	0.16	14.1	Absent	11.44 & 11.64
Withers, North, Tex.	26.1	0.16	2.9	Absent	11.16 & 11.43
Yates, Tex.	29.1	1.59	22.6	Absent	11.49 & 11.57
Intermediate Naphthene					
Gato Ridge, Calif.	13.8	5.21	9.1	Absent	11.45 & 11.10
Baxterville, Miss.	15.0	3.07	4.9	Absent	11.74 & 11.42
Agua Dulce, Tex.	37.0	<0.10	25.3	Present	11.57 & 11.28
La Rosa, Tex.	42.1	<0.10	40.8	Present	11.62 & 11.22
Magnet-Withers, Tex.	25.9	0.15	2.6	Absent	11.16 & 11.49
Plymouth, Tex.	39.0	<0.10	40.7	Present	11.52 & 11.06

*Taken from Bureau of Mines Hempel Analyses, Repts. Invest. 4289, etc.

†Up to a boiling point of 392° F.

‡First value for distillate-like material (504° F. boiling point) and the second for lube materials (756° F. boiling point).

§See Questions on Technology March 9, 1950, and March 23, 1950.

Smoke Point

Do you have any information on the relation of smoke point to some other test such as thermoviscosity or aniline point that is more easily obtained?—J. H. B. D.

Apparently the smoke point of kerosine (Institute of Petroleum Test K. 36, London) bears no direct relationship to other common tests. Of course, the apparent lack of correlation may be due to an inadequate amount of experimental data, or it may be due to inaccuracies in conducting the smoke-point test.

Meager and approximate data were published on this page in the October 14, 1948, issue (page 119). The relationship between specific gravity and smoke point was developed. However, the smoke point for a constant specific gravity varied by as much as 8-10 units. The relationship to other properties such as characterization factor and aniline point was about equally poor. Nevertheless, the approximate relationship of smoke point to other variables has been published in the form of a tabulation on the Questions on Technology page of March 23, 1950 (page 348). Except for the most gross approximations it is suggested that smoke points should be determined experimentally.

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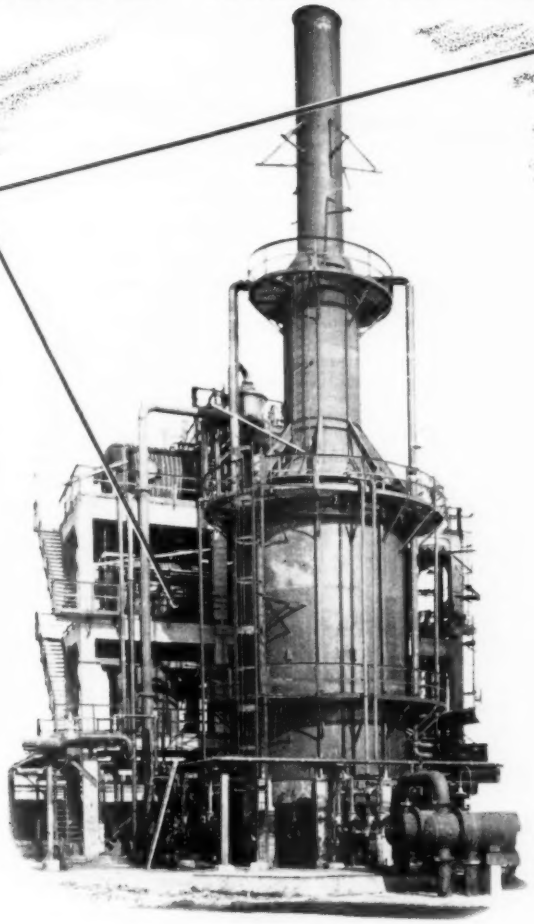

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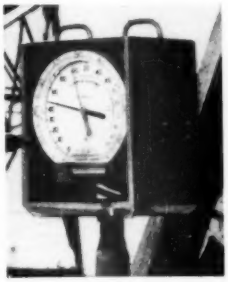

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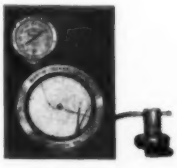

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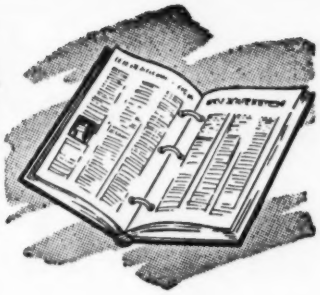

Automatic Analytical Methods*

PHYSICAL and chemical qualities, such as infrared absorption spectras, turbidity, color, etc., which yesterday were limited to manual methods of analysis, today are being analyzed automatically. Probably tomorrow the imaginative engineer will use these variables automatically to control his process.

Infrared and ultraviolet spectrometers, used for quantitative and qualitative determinations in the manufacture of high-octane gasoline and butadiene for quality control, are also used, in modified form, for continuous analysis and sometimes to control process streams.

Another example illustrating the trend towards automatic analytical methods and one which has opened new vistas for tower control is the refractometer which continuously measures the refractive index of a flowing fluid.

Refractive Index

Formerly, measurement of refractive index was confined to the laboratory and to manual determination by visual means. Hence, such methods were not conducive to process control. With the advent of a means for continuously measuring the refractive index, a possible solution to many difficult distillation control problems became manifest. To cite an example —in the separation of styrene from its parent material by fractional distillation, separation by conventional temperature control is difficult and often unreliable due to the proximity of the boiling points of parent and product materials. However, since the refractive indexes of the materials are widely separated, control by this means is exceedingly effective. In actual production, control is obtained by maintaining a constant steam pressure on the reboiler and automatically regulating the reflux rate by means of the refractometer.

Spectrometers

Probably the largest single classification of automatic analyzers associated with the petroleum industry comprises the spectrometer. This includes principally the Raman, the mass, visible, infrared, and ultraviolet spectrometers, all of which have their specific uses and advantages.

Raman spectrometers. — These provide a technique for revealing basic information concerning the molecular structures of compounds and also for both the qualitative and quantitative analysis of mixtures. Many inorganic and most organic compounds manifest characteristic Raman spectra. For example, all hydrocarbons reveal characteristic spectra as a result of the difference in the frequency with which their atomic groupings vibrate and rotate. Thus, the kind of atoms present, their arrangement within the molecule, and the type of interatomic linkages are all factors which can be determined with the Raman spectrometer. At present, Raman equipment automatically produces a recorded analysis of the characteristic Raman spectrum of a sample. Although the realm of possibility, no control applications have been forthcoming as yet for this kind of equipment.

Mass spectrometers.—These provide a means for rapidly and precisely determining chemical composition of materials in the gaseous state, and frequently in liquid or solid form. The principle is separation of the molecules of a sample according to their mass.

The apparatus facilitates the analysis of light hydrocarbon streams, such as overheads and bottoms of depropanizers and debutanizers, and some of the heavier and more complex hydrocarbons. A typical depropanizer overhead analysis resolves normal butane, isobutane, propane, ethane, and methane. Thus an analysis by mass separation aids in setting up a distillation column for maximum yield, aids in determining strategic tray locations, and reflux ratios. At present, the mass spectrometer functions as an analytical tool for qualitative and quantitative determinations in production and research laboratories and as yet has no modified versions for use as a direct process-control element.

Infrared analyzers. — Some infrared spectrometers provide a recorded evaluation of infrared absorption at various wave lengths from which both quantitative and qualitative determinations can be made.

On the other hand, an infrared analyzer provides a continuous recorded evaluation of infrared absorption at any one particular wave length from which a continuous quantitative determination of concentration can be obtained. It is evident that this latter unit is readily applicable to process control where it may be used to regulate the concentration of one liquid or gas in a mixture. *(Ed. note—plant installations of automatic infrared analyzers were described in the March 23, 1950, issue of The Oil and Gas Journal, page 272.)* In a like manner, an ultraviolet spectrometer is used to control the concentration of certain ingredients in a process stream.

Since practically all substances exhibit characteristic infrared absorption spectra and certain petroleum derivatives exhibit ultraviolet absorption spectra, the use of these two spectrometers has large potential.

Essentially, the difference between the laboratory version of the infrared analyzer and its process-control counterpart is one of construction. The laboratory analyzer is equipped with mechanisms for scanning and recording the entire spectrums as well as recording simultaneously, the amount of absorption at each frequency scanned. The analyzer for process control is designed to be sensitive to one particular frequency—that frequency at which the substance under analysis manifests absorption. Thus, the analyzer is sensitive to but one substance and by evaluating the amount of radiation at one frequency which passes through a sample containing the substance, the analyzer is enabled continuously to determine quantitatively the concentration of that substance in the sample. With this as a basis, it is but a short step to employ this method of sensing changes to the control concentration of various ingredients in a plant stream.

*Portion of paper, "Petroleum-Refinery Instrumentation," by D. M. Considine, Minneapolis-Honeywell Regulator Co., presented at the thirty-eighth annual meeting of the Western Petroleum Refiners Association, San Antonio.

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Coring to Obtain Fluid Saturations

ONE of the principal reasons for procuring core samples is to examine them for fluid content. Sometimes this is only a qualitative test but generally a fairly quantitative test is desired. In discussing this problem one must first answer the question of whether the core samples are representative of the reservoir. This has been discussed previously. *(Engineering Fundamentals No. 401)*. There is also the second question of whether the core sample is obtained with a representative amount or type of fluids. There is the third question of measuring the amount and type of fluid after the sample is procured.

A core sample when finally analyzed for fluid content has been subjected to a mechanical coring process, to varying pressures and temperatures and to contact with other fluids. A definite time interval has also elapsed between the time the formation was first exposed and the time the analysis is made. For these reasons original fluid within the core sample may have either been lost or replaced. Loss of fluid from a core may occur by evolution of gas under a pressure reduction, by drainage, by action of capillary forces, or by evaporation. Loss of fluid by replacement results primarily from the use of a fluid under pressure in the coring process.

Different factors contribute to each of these types of loss. Loss due to gas evolution is in direct proportion to the amount of gas in solution, to the oil shrinkage due to loss of gas under the pressure reduction experienced, and to the relative permeability character of the formation being cored. Loss due to drainage is primarily dependent upon the permeability of the core and the oil viscosity. Loss due to evaporation depends primarily upon the type of hydrocarbons present and the surface of the core that is exposed. All are of course dependent upon the time interval during which they are allowed to operate.

Superimposed on all of these factors is the replacement of formation fluids by the coring liquid. Most coring techniques require the use of a fluid during coring to act as a lubricant and coolant, and to maintain a pressure on the formation being cored. If the pressure maintained during coring is greater than the pressure within the formation, then flow must occur into the formation being cored. If the pressure maintained during coring is less than the pressure within the formation then flow must occur from the formation being cored.

Several practices have been proposed to correct for fluid loss or to preclude its occurrence. These are (1) to use a fluid for coring which cannot displace one of the desired fluids from the formation and test for the latter when the core is recovered, (2) to use a coring fluid that can be detected by subsequent analysis so that the amount of coring fluid that penetrated the core can be measured, (3) to use a coring fluid that will not penetrate or will penetrate only a negligible distance, or (4) to core with a zero or negligible pressure differential between the coring liquid and the formation.

It is impossible to state which of these devices would prove most practical without some knowledge concerning the fluid condition of the formation being cored and the fluid content desired in the sample analysis. The probable formation conditions are those containing (1) only oil and water, the water being at the irreducible amount, (2) only oil and water, the oil being at the irreducible amount (3) only oil and water, neither being at the irreducible amount (4) oil, gas, and water, the water being at the irreducible amount, (5) oil, gas, and water, the oil being at an irreducible amount, and (6) oil, gas, and water, none at an irreducible amount.

In situations (1) and (4) where water is present in its irreducible amount, the coring fluid can be oil or oil-base mud, and the core sample can subsequently be analyzed for its water content only. This is the general intent of using oil for coring, but it is emphasized that such cores do not give true values of connate water unless water is present in its irreducible amount. A further hazard to this technique is the difficulty of making the oil or oil-base fluid entirely free from water.

In situations (2) and (5) where oil is present in an irreducible amount, the coring fluid can be water with subsequent sample analysis being made for oil. This situation might occur in a gas-cap zone or behind a water drive where it is desired to evaluate residual oil.

In situations (3) and (5) where neither oil or water is present in an irreducible amount, neither of them as a coring fluid can give reliable samples for fluid analysis.

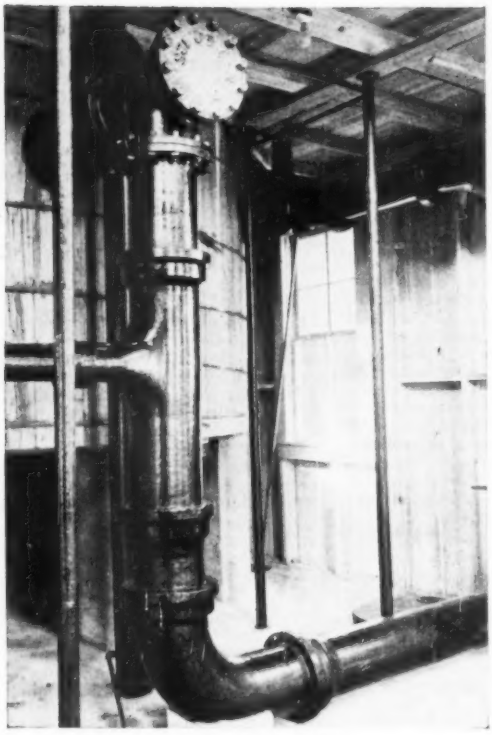
Coring with fluids that can be traced is adaptable to any situation, if, by subsequent analysis for the tracer, penetration can be shown to be nonexistent or negligible. However, where penetration is shown to be appreciable no further information is obtained from the use of a tracer unless it is known which original fluid was replaced by the penetration.

Perhaps the use of a coring liquid to yield negligible penetration shows greatest promise of yielding practical results. Penetration can be kept to a minimum, aside from using a negligible pressure differential, by speeding up the coring process or by slowing down the rate of penetration. Two ways to accomplish the latter are (1) to use a coring fluid of high viscosity, and (2) to erect a flow barrier. Increasing the viscosity of a water-base mud is not an increase in viscosity of penetrating fluid because only the water is lost from the mud to the formation. A viscous emulsion would represent an increase in drilling fluid viscosity only if the emulsion did not break prior to entering the formation being cored. An emulsion would be desirable in this respect because there would be an increased resistance to penetration due to the presence of two phases. A viscous oil could be used as a high viscosity coring liquid.

The erection of a flow barrier is accomplished most readily by a low-water-loss drilling fluid. The flow barrier might also be accomplished by any other conceivable mechanical barrier.

It is apparent that the direct determination of oil content by coring methods is practically impossible except where oil content is at an irreducible amount. It is generally more reliable, therefore, to measure water content and obtain oil content by difference.

Series by Dr. John C. Calhoun, Jr., Chairman, Petroleum Engineering School, University of Oklahoma



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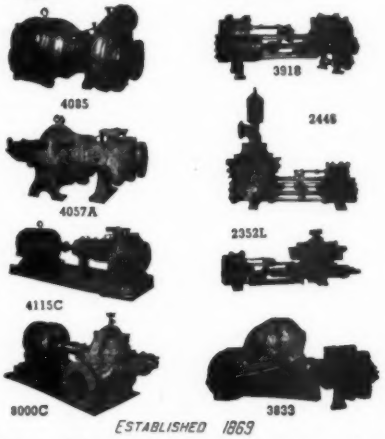

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PIPE LINES

Tapline Project

809 miles of pipe received in field

FOR the entire Trans-Arabian Pipe Line Co. project, 809 miles of pipe had been received in the field of the 889 miles shipped by the middle of April.

For the western end 134 miles had been shipped and an additional 21 miles was en route at that time. The entire 25-mile section in Lebanon has been welded; 10 miles of right-of-way had been cleared in Syria by the middle of April. Eleven of the 16 180,000-bbl. tanks for the Sidon terminal are being erected, and station construction is on schedule. Tapline field employes include about 1,500 Americans and slightly more than 9,000 foreigners of various nationalities.

At the northeast end of the Trans-Arabian project, work is being carried on by several gangs of Williams Brothers Overseas Co.

One spread has been working out of the Mediterranean terminal at Sidon, Lebanon. Preparations are being made for putting a small crew in the field at Quaitra, Syria.

At the Sidon terminal six 36-in. 5,000-6,000 ft. sea-loading lines are being built by Williams Brothers together with piping, tankage, and pumps. Oil will flow by gravity from the tanks to tankers moored offshore. Tanks are being erected by Graver Tank & Manufacturing Co., Inc. Pumps will unload ballast water from tankers.

Tapline construction operations handled by Williams Brothers are directed by David R. Williams, who will remain in Beirut, Lebanon, until completion of the project; A. M. Garber is general manager; George Allen is general superintendent in charge of pipe-laying operations; J. H. McCartney supervises construction of facilities at the Sidon terminal.

The section of 30-31-in. pipe being laid for Tapline is somewhat less than 300 miles long extending from Sidon to the border of Saudi Arabia. International Bechtel, Inc., is reported to have a spread working northwestward from a point approximately 250 miles from the Saudi Arabia border where it will meet a Williams Brothers spread going southeastward.

FPC Decision Near

WASHINGTON.—Federal Power Commission has granted the motion of Southern Natural Gas Co., Birmingham, for omission of intermediate-decision procedure in the proceeding involving that company's application for authorization to expand the capacity of its pipe-line system in the south.

This means that the case will go directly to the commission for decision without an intermediate decision by the presiding examiner. Public

RIVER TRENCH.—Preparations for shooting trench in rocky river bottom near Gainesville, Tenn., during construction of East Tennessee Natural Gas Co.'s 22-in. line contracted by Oman-Fulton-Brodie Co. Barge-mounted spudder for drilling shot holes has been moved away from the two rows of pipe nipples at the shot holes.

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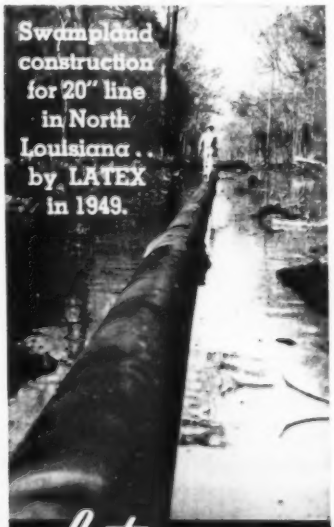

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J. W. Sharman — R. P. Gregory

hearing in the application was held April 4.

Southern Natural is proposing to construct additional facilities in Texas, Louisiana, Mississippi, Alabama, Georgia, and South Carolina. The project, estimated to cost $32,928,630, would increase capacity of the company's pipe-line system by 109,000,000 cu. ft. per day to a new total daily capacity of 529,000,000 cu. ft.

Associated Hearing Set

WASHINGTON.—Federal Power Commission has scheduled a hearing May 2 here on application of Associated Natural Gas Co., Tulsa, which is seeking authorization to construct pipe-line facilities in southeastern Missouri.

Associated proposes to build 14½ miles of 8⅝-in. line, and 21 miles of 6⅝-in. line, and gas distribution systems in Sikeston and New Madrid. Estimated cost has been set at $900,000.

Pipe Liners Meet

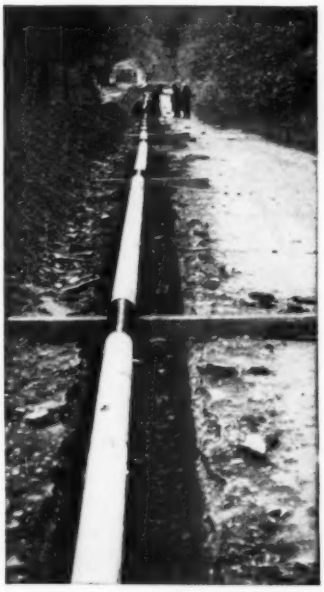
Tulsa group discusses operating problems

TULSA.—A variety of pipe-line problems were discussed by superintendents and engineers at a round-table session at the recent monthly meeting of the Pipe Liners Club of Tulsa, dealing with gaging, disposal of ice, and costs of pumping-unit operation.

To obtain more accurate temperature readings used in tank-gaging calculations, attention was given to the desirability of having tank roofs constructed in such a way that temperature readings could be taken at several positions. It was pointed out that the present practices of relying on one temperature reading taken near one side of a tank could lead to substantial errors under conditions where the temperature of the crude oil or products would differ between the sunny side and shady side of a tank.

While there was considerable discussion of the advantages of hand gaging, the extensive recent successful experience with automatic tank gaging was reported as evidence that its value has been definitely established for future operations. Provisions made for guiding the floats of automatic gages have reduced errors which may be possible or a result of turbulence.

Pipe-line men operating in northern Rocky Mountain areas reported on the benefits derived from using strainers as ice traps, particularly where "bead" ice is present in crude oil. Such bead ice is formed originally on the underside of tank roofs, in periods of sudden, drastic drops in temperature. This bead ice gives



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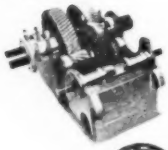

...IN PUMPING

Pacific-Western speed reducers designed especially for oil field service save maintenance dollars.

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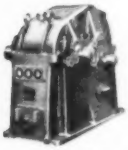
Operating costs on old wells can be cut to the absolute minimum by installing Pacific-Western bandwheel drives.



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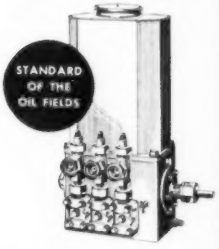

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pumping trouble. A type of slotted strainer installation was described which is buried in gravel in the station yard and served by a jury crane.

Advantages of hot-water cleaning of scrapers for crude-oil lines were emphasized for melting wax in the performance of what is usually a messy job.

Engine and pump costs are being rapidly and conveniently calculated by modern business-machine methods recently applied for certain pipeline accounting systems devised primarily to assist superintendents and engineers. It was reported that within 10 minutes it is possible to get costs of labor and materials for any pump or engine on a pipe-line system. Such figures are valuable in reaching decisions as to whether a unit should be overhauled or replaced. However, it was reported that no satisfactory method had been devised for directly comparing horsepower costs to units operated by a single company or several companies.

Volume Drops

Flow of oil in lines down during 1949

WASHINGTON.—Volume of oil transported by leading pipe-line systems in the United States declined in 1949 as compared with 1948, but at the same time revenue of these carriers registered a slight increase, Interstate Commerce Commission reports show.

Based on reports of 47 pipe-line companies having an annual operating revenue of at least $500,000, the figures disclose that traffic in 1949 amounted to 2,319,152,971 bbl., or a drop of 9.4 per cent from the preceding year. Revenues in 1949 amounted to $344,128,274, or a gain of 0.2 per cent from 1948.

Humble Pipe Line Co. handled the largest volume. It transported 223,207,065 bbl., or 25.4 per cent below the total volume of that company in 1948.

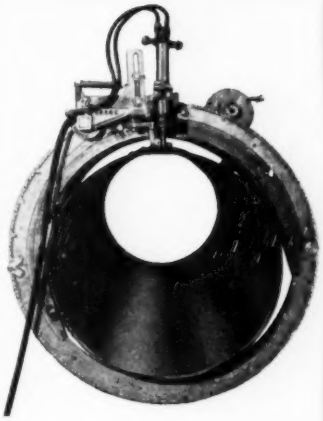
Other leaders in total volume transported included: Interstate Oil Pipe Line Co., which handled 161,262,707 bbl., off 6.5 per cent; Texas Pipe Line Co., 143,794,734 bbl., down 6.8 per cent; Stanolind Pipe Line Co., 140,599,969, off 4.2 per cent; and Buckeye Pipe Line Co., 144,305,511 bbl., off 2.4 per cent.

Largest revenue earner was Stanoline Pipe Line Co., Tulsa. It took in $38,470,195, an increase of 9.1 per cent from 1948.

Humble's revenue in 1949 was $30,313,189, which was the second largest. However its earnings were down 18.3 per cent from the preceding year.

Sinclair Refining Co. reported revenue of $27,681,947, which made it third in rank. An increase of 9.9 per cent from 1948 was recorded.

PIPE CUTTING AND BEVELING



Crose pipe cutting and beveling machine for fast true cutting and beveling of pipe. Available in six sizes for 4" to 36" pipe. All machines are built of high strength, light weight aluminum alloys. The continuous ring which goes around the pipe is hinged so that these machines may be installed as easily from the side of the pipe as from the end. Machines for 16" pipe and above have "Out-of-Round" attachment as standard equipment.

WRITE FOR BULLETIN BM-1001

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NATURAL GAS

Canadian Support

Country asks FPC to O.K. Panhandle project

WASHINGTON.—The Canadian Government last week officially asked that the Federal Power Commission make it possible for that country to receive 75,000,000 cu. ft. of natural gas daily from Panhandle Eastern Pipe Line Co.

W. D. Matthews, minister in the Canadian Embassy here, testified at an FPC hearing in support of Panhandle's application for authority to proceed with a $125,000,000 expansion program which would enable the company to increase its daily supply of natural gas from 500,000,000 to 800,000,000 cu. ft. It has agreed to furnish 75,000,000 cu. ft. of its additional capacity to Union Gas Co. of Canada *(The Oil and Gas Journal, April 6, 1950, page 99)*.

A number of United States firms are opposed to the Canadian proposal if it deprives them of extra quantities of gas they claim they need. Michigan Consolidated Gas Co., Panhandle's largest customer, has been notified that its allotment of 125,000,000 cu. ft. daily will be cut to 87,500,000 cu. ft. December 31, 1951. Michigan Consolidated is asking for an increase of 75,000,000 cu. ft. instead of a cut. This is the exact amount Panhandle proposes to furnish to the Canadian firm.

Matthews said it was his understanding that Panhandle Eastern would be able to give Union Gas 75,000,000 cu. ft. without detriment to its United States customers. The Canadian company must obtain its natural gas from this country because of the serious depletion of natural-gas reserves of Southwest Ontario and the importance of natural gas to the economy of that important industrial region, he said.

The commission scheduled oral arguments to open April 26 on both the Panhandle application and Trunkline Gas Supply Co.'s proposal to build a 740-mile Louisiana-to-Illinois pipe line which would deliver approximately 250,000,000 cu. ft. of gas daily to Panhandle.

Hearings Consolidated

WASHINGTON.—Proceedings involving applications of Transcontinental Gas Pipe Line Corp. and Carolina Natural Gas Corp. have been consolidated by Federal Power Commission. Hearing on the latter proposal will begin here May 1.

Carolina Natural is seeking to construct a system of lateral pipe lines to supply natural gas to distributors of manufactured gas in communities in North and South Carolina, and has asked FPC for an order directing Transcontinental to supply the gas for the project. Carolina Natural would construct 372 miles of line, consisting of 18 laterals having an aggregate design capacity of 140,000,000 cu. ft. daily, extending from Transcontinental's main transmission line to the various Carolina markets.

The portion of the proceedings relating to Transcontinental's application involves that firm's proposal to build facilities needed for service to the New England area. Carolina Natural requested FPC to consolidate the two proceedings, contending that the question of whether Transcontinental should be permitted to extend its facilities to connect with those of Northeastern Gas Transmission Co. cannot properly be determined until FPC considers the issues presented by the Carolina plan.

Estimated cost of Carolina Natural's proposed project is $7,332,200.

New Line Authorized

WASHINGTON.—Authorization to build a total of 12 miles of pipe line for transportation of natural gas to and from two underground-storage pools in West Virginia has been given by Federal Power Commission to United Fuel Gas Co., Charleston, W. Va.

The line, including 3 miles of 10¾-in., and 9 miles of 20-in., will transport gas received from Tennessee Gas Transmission Co.'s pipe-line system to storage pool near Nitro and Clendin. Estimated cost of the project is $1,326,000.

Appliance Short Course

TULSA.—Plans are being readied for the 1950 short course in gas appliances, which will be offered by the College of Petroleum Sciences and Engineering at the University of Tulsa. Southern Gas Association is sponsor of the course, which will be at the university May 31-June 2.

Included on the program will be discussions on new developments in appliances, and the future of the gas industry. Servicing, installation, and new products will be explained in the various technical sessions.

Gas Curbs to End

JEFFERSON CITY, Mo.—Restrictions on a number of Missouri cities placed on use of natural gas for commercial space heating of buildings where new installations are under way or proposed will be removed by the Missouri Public Service Commission on May 1.

Gas Reserves Cited

WASHINGTON.—A petroleum engineer told the Federal Power Commission here last week that 2½ trillion cubic feet of natural-gas reserves are now held by El Paso Natural Gas Co. in the San Juan basin area.

Testifying before the commission, J. F. Dougherty, of the firm of DeGolyer & MacNaughton, Dallas, first placed estimated reserves contracted for by El Paso in the Barker dome field of the basin at 1½ trillion cubic feet.

El Paso is seeking authority to construct a natural-gas pipe line from the San Juan basin to supply several Arizona towns and deliver 150,000,000 cu. ft. of gas daily to Pacific Gas & Electric Co. at a connection with P.G.& E.'s system at Topock, Ariz. The gas would be resold by P.G.& E. in the San Francisco Bay area.

El Paso plans to draw new gas supplies from the Scurry County, Texas, fields to augment the supplies available from the San Juan basin area. The company has already been granted permission to build a pipe line to transport 250,000,000 cu. ft. of gas daily from the Permian basin to California.

Alum Rock Bid Approved

WASHINGTON.—Federal Power Commission has authorized Alum Rock Gas Co., Port Allegany, Pa., to abandon natural-gas service to United Natural Gas Co., Oil City, Pa.

Alum Rock's application states that United Natural now has available sufficient quantities of gas from other sources and that the two companies have agreed to terminate their existing contracts as of April 14. Alum Rock stated further that it has not yet determined what it will do with the facilities presently used for delivery of gas to United Natural.

Natural Gasoline

Pecos Plant Expansion

PECOS, Tex.—Construction work on expansion of Pecos Petroleum Co.'s natural-gasoline plant near Orla, Tex., is expected to be completed by August 15.

T. C. Shaw, plant manager, said that about 60 men are now at work on the construction program, which will expand the plant to maximum capacity. Absorption-plant facilities will be capable of producing about 30,000 gal. of gasoline and liquid gas daily.

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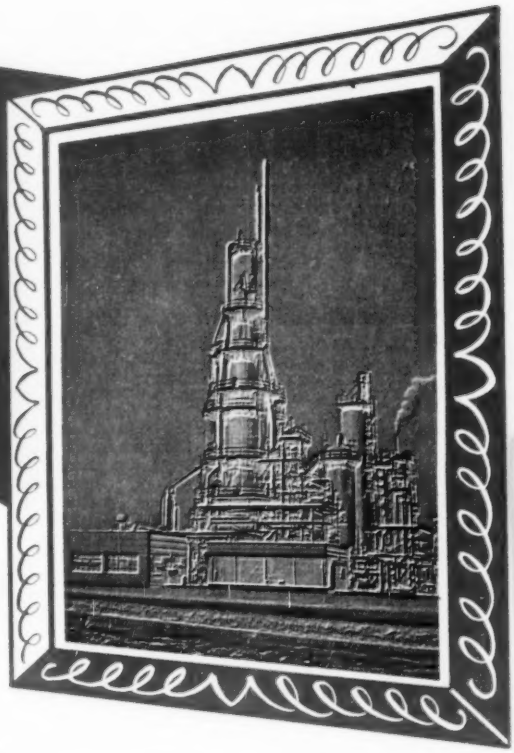

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Building a new refinery or remodeling your old may be the answer to greater profits through the years to come. You can make a determination of your needs and possibilities through a REFINERY ENGINEERING Company study of operating costs, yields, and profits on any proposed construction. Conferences with us will determine the proper type of plant to give you the greatest realization of profit and quickest return on your investment.

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REFINING

Synthetic Gasoline

Brownsville, Tex., plant to begin operation soon

BROWNSVILLE, Tex.—The first commercial synthetic-gasoline plant in the United States will be put in operation here soon. It will produce 6,000 bbl. of gasoline, 900 bbl. of diesel oil, 200 bbl. of fuel oil, and 300,000 lb. of by-product chemicals daily.

Frank M. Dawson, vice president of Carthage Hydrocol, Inc., owners of the plant, said that final tests are now being conducted, and that actual production of synthetic gasoline should begin around May 1. Gasoline, oils, and chemicals will be made from natural gas in a process developed by Stanolind Oil & Gas Co., Tulsa.

Dawson said that the process is known as "hydrocol" and that the synthetic material results from the burning of natural gas with oxygen under controlled conditions to produce carbon monoxide and hydrogen.

The mixture of carbon monoxide and hydrogen is then passed over a catalyst to produce gasoline and diesel oil. Halfway through the process, the byproduct chemicals (as many as 20) are removed. Several of the chemicals produced are used for medical purposes, Dawson said.

Blast Damage Slight

CUSHING, Okla.—Damage caused by a blast and flash fire in a brick compressor room at Deep Rock Oil Corp.'s refinery 3 miles north of here was slight, due to alertness of employes, Thell Woods, superintendent, said. Four workers were injured.

The compressor machine, used in processing raw gas to high-octane fuel, was shut down prior to the blast. When an attempt was made to start it after repairs had been made the blast occurred.

Fuel Contracts Let

WASHINGTON.—Contracts for more than 1,000,000 bbl. of aviation gasoline and jet fuel, to cost $5,755,000, have been placed by the Armed Services Petroleum Purchasing Agency, it was announced by the Navy Department last week.

The contracts call for the supply of 2,500,000 gal. of aviation gasoline, grade 80, at a cost of $383,075; 22,030,000 gal. of 100-130 at a cost of $3,391,332; and 22,270,000 gal. of JP-1 and JP-3 at a cost of $1,980,987, as follows:

Aviation gasoline, grade 80: Gulf Oil Corp., Pittsburgh, 1,050,000 gal. at $149,625; Esso Standard Oil Co., New York, 1,450,000 gal. at $233,450.

Aviation gasoline, 100/130: Phillips Petroleum Co., Bartlesville, Okla., 4,748,000 gal. at $747,147; Cities Service Oil Co., New York, 1,500,000 gal. at $230,020; Standard Oil Co. (Ky.), Louisville, 5,880,000 gal. at $1,014,120; Esso Standard Oil Co., New York, 6,723,000 gal. at $900,090; Gulf Oil Corp., Pittsburgh, 1,667,000 gal. at $275,055; Magnolia Petroleum Purchasing Agency, Dallas, 1,512,000 gal. at $224,900.

Aviation fuel, JP-1 and JP-3: Bell Oil & Gas Co., Tulsa, 2,550,000 gal. at $214,710; Pontiac Refining Co., Corpus Christi, Tex., 6,630,000 gal. at $510,957; General Petroleum Corp., Los Angeles, 10,560,000 gal. at $913,470; Standard Oil Co. (Cal.), San Francisco, 1,200,000 gal. at $112,200; Ashland Oil & Refining Co., Ashland, Ky., 1,300,000 gal. at $139,000; Arrow Oil Co., Baltimore, 850,000 gal. at $90,650.

Sunray Plant to Reopen

TULSA.—Sunray Oil Corp. will resume operations at its 12,000-bbl. per day Allen, Okla., refinery about May 1 because of increased demands for all kinds of products.

The plant, shut down since November 1949, is equipped with a three-coil thermal cracker, from which gasoline is blended with high-grade catalytically cracked gasoline.

The refinery will be operated 24 hours a day on a trial basis for a 90-day period.

May Join Opposition

OIL CITY, Pa.—The Pennsylvania Grade crude-oil industry may get an ally in urging that no Marshall plan aid funds be used for expansion of foreign oil refining facilities beyond their prewar size, Pennsylvania Grade Crude Oil Association announced here last week.

Indications are that other segments of the nation's petroleum industry will join the Pennsylvania Grade group, which has taken the initiative in pointing out to Congress the threat to American lubricating-oil exports represented by ECA policies in using Marshall plan funds to finance refinery construction abroad, the association declared.

H. A. Logan, Warren, Pa., told fellow directors of the Pennsylvania Grade Crude Oil Association at a meeting here that exports of lubricating oils from this country in 1949 amounted to 35,000 bbl. daily, or one-quarter of the average daily production of 140,000 bbl. "Marshall plan funds threaten to eliminate a large portion of the 35,000-bbl.-per-day

shipments overseas," he said, adding that, if the present trend continues, lubricating-oil exports from the United States would cease by 1953, at the end of the Marshall plan program.

Logan was one of the spokesmen for the Pennsylvania Grade crude-oil industry from the association who testified recently before the Keogh subcommittee of the House small business committee in opposition to use of ECA funds for purposes other than rehabilitation of war-devastated oil refineries overseas.

Fire Damages Plant

DUMUS, Tex.—Damage estimated at from $50,000 to $100,000 was caused by a flash fire and explosion last week in a gasoline-treater unit at Shamrock Oil & Gas Corp.'s McKee refinery 11 miles southeast of here.

Harry Wheeldon, vice president in charge of operations, made the damage estimate. No one was injured.

New Building Occupied

DALLAS.—A new 10-story, $3,000,000 office building constructed as southwest headquarters offices for Atlantic Refining Co. has been completed and is being occupied by the company. Located at 408 Bullington, the structure is of welded-steel construction, faced with Indiana limestone, and is completely air conditioned.

Wax Committee Named

Organization of a new technical commitee on petroleum wax, under joint sponsorship of American Society for Testing Materials and the Technical Association of the Pulp and Paper Industry, was announced by the A.S.T.M. D-2 Committee recently.

There is considerable interest in the work to be undertaken by the committee because of the need for test methods for wax, and particular, wax products such as wax papers. Officers of the committee are: A. M. Heald, Marathon Corp., chairman; R. B. Killingsworth, Socony-Vacuum Oil Co., Inc., vice chairman; and A. P. Anderson, Shell Oil Co., secretary.

New Lube Tester

SCHENECTADY, N. Y. — General Electric Co. has developed a compact, semiportable device for low-temperature testing of ball-bearing lubricants. Lubes used in such applications as aircraft gun turrets must be effective at temperatures as low as 65° below zero, and the new apparatus simplifies testing problems since it eliminates need for elaborate cold rooms.

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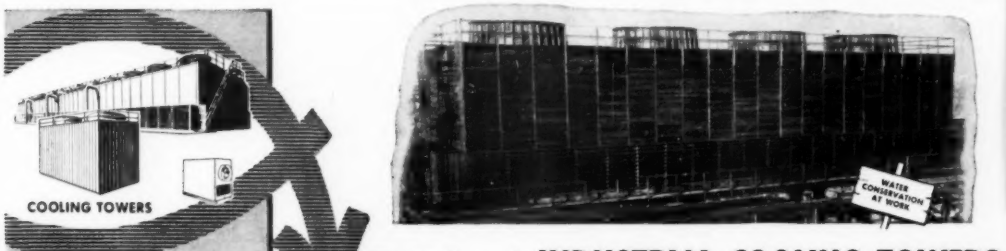

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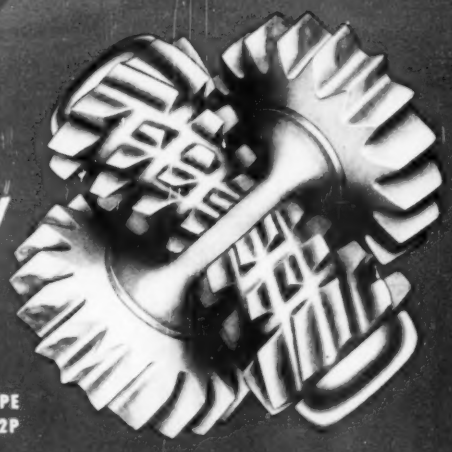

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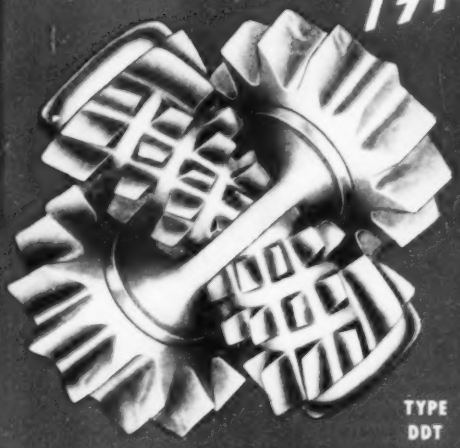

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Long-tooth bits—pioneered, developed and first made by H. C. SMITH—are favored by drillers for their speed in making hole in the more unconsolidated formations usually met in top hole digging. And more and more drillers prefer H. C. SMITH long-tooth bits because they do more than make footage fast—they drill straight, full gauge hole.

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PIONEER OF LONG-TOOTH BITS FOR TOP HOLE DIGGING

Among the Drilling Contractors

Deeper Drilling Boosts Work in Arkansas Field

Development of the recently discovered deeper-producing horizon, the Smackover lime, in the shallow South El Dorado field, Union County, Arkansas, is expected to provide considerable new work for drilling contractors in that area.

Zack Brooks Drilling Co., El Dorado, already has tools running on the first of two additional Smackover tests which C. H. Murray & Co. has projected to confirm its discovery of the deeper zone, found at a depth of around 7,600 ft.

The drilling test is 2 Olsen, NW NE 32-18s-15e, a 40-acre location northwest of the discovery well. The other projected test is 1 Decimus, SW SW 33-18s-15w, a location southeast of the discovery well.

Johnson Made President Of Drilling Organization

H. Blume Johnson, formerly vice president and general manager, has been elected president of Butler-Johnson Service Corp., Shreveport. In his new capacity, he heads an organization which has been active in oil-well drilling and well-servicing and workover operations in North Louisiana, South Arkansas, East Texas and Mississippi. Prior to his association with J. R. Butler in the formation of the present corporation, Johnson was general manager of the Operators Committee of the Haynesville field, North Louisiana.

Adkins Awarded Contract For Kansas Deep Wildcat

Adkins Drilling Co., Great Bend, Kans., has been awarded the contract for a projected 7,500-ft. wildcat test to be drilled for Skelly Oil Co. in southeastern Meade County, southwestern Kansas. Location for the test, 1 McKinney, in the NW NW NE 2-34-26, is about 8½ miles north of the Oklahoma Panhandle line, 23 miles to the east of the East Adams Ranch gas field (nearest production of any kind), and 40 miles east of the Hugoton gas field. Objective is the Arbuckle lime.

On Location 2 Years

After spending more than 25 months on the location, Rocky Mountain Drilling Co., Los Angeles, has been released from a deep wildcat test it drilled for Standard Oil Co. of California in Kern County, California. The test, 45 Van Sicklin, 5 miles southeast of Lost Hills, has been

On location in the Beckville extension area of the Carthage field, Panola County, East Texas, where Wheless Drilling Co., Shreveport, is contracting for Union Producing Co. Top row, left to right: Jack Taylor, toolpusher, Wheless Drilling Co.; W. L. Davis, superintendent, and R. D. Wroten, engineer, Union Producing Co.; Floyd Burson, evening-tour driller. Bottom row, same order: W. N. Griffith, derrickman; W. M. Lee and R. A. Speer, floormen.

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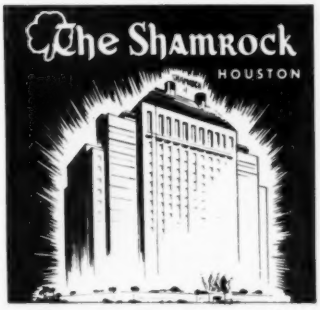

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abandoned following a long series of unsuccessful tests. It was spudded February 12, 1948, and was drilled to a total depth of 14,597 ft. Testing has been under way since last August.

Rankin & Pitcock, Graham, Tex., have a rig running for Harry and J. L. Trentman at a wildcat location, 1 Cutch, in the S. Armstrong Survey, 8 miles northwest of Springtown, Wise County, North Texas. Contract is for 6,500 ft.

Briscoe & Clingman Drilling Co., Oklahoma City, is drilling Forrest Parrott 1-B Katie, SE SE 34-12n-3w, Oklahoma City field, Oklahoma County, Oklahoma.

Rocky Mountain Drilling Co., Los Angeles, has been awarded contract to drill a deep test for C. D. Cunningham and Paul Stock in the Ventura Avenue field, coastal California. The well, 1 Notten, will be carried to 12,000 ft.

Reserve Drilling Co., Great Bend, Kans., is drilling for Nadel & Gussman at a wildcat location, 1-B Baldwin, in 30-9-20, Rooks County, Kansas.

R. Benton Ross, Wichita Falls, Tex., is the contractor on a shallow wildcat test being drilled for Hunter Marston, Jr., and J. Ben Russell at 1 Taylor-Neilson, 6-5s-11w, 3 miles east of Randlett, Cotton County, southern Oklahoma.

Karl L. Kellogg & Sons, West Coast drilling contractor with headquarters in Long Beach, is making hole below 7,000 ft. at Universal Consolidated Oil Co.'s wildcat in San Luis Obispo County, California. The test, 1 SM-Humble, is 7 miles northwest of the Russell Ranch field in northern Cuyama Valley. Kellogg also has a rig busy recompleting Hancock Oil Co. E-6 in the Wilmington field.

Tine Gaiser, Bakersfield, Calif., is drilling for Golden Bear Oil Co. at 26-1 Weichelt, latest test to be started in the Edison field area, Kern County, California.

ROTARY RIGS IN OPERATION*

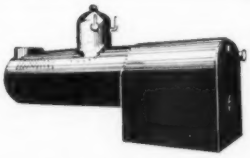
(United States and Western Canada)

Area—	Week ended 4-17-50	Change week ended 4-10-50	Change week ended 4-18-49
Gulf Coast	499	— 15	— 71
W. Tex.-N. M.	718	— 10	+ 155
Ark.-N. La.-E. Tex.	117	— 5	— 24
Oklahoma	261	+ 5	— 1
Kansas	120	— 9	+ 12
Illinois-Eastern	91	— 3	— 37
Rocky Mountains	63	— 3	— 44
Pacific Coast	131	— 3	— 41
Total United States	2,000	— 37	— 51
Western Canada	63	— 1	— 16
Total	2,063	— 38	— 67

*Courtesy Hughes Tool Co.

Danciger Oil & Refining Co., Fort Worth, is drilling for **Richardson & Bass,** also of Fort Worth, at 1 Brooks, a projected 12,500-ft. wildcat test in 22-3s-11e, Washington Parish, southeastern Louisiana.

Southeastern Drilling Co., Jackson, Miss., is the contractor on a projected 7,200-ft. wildcat test which Sun Oil is starting in Baldwin County, Alabama. Location is in 18-1n-3e.



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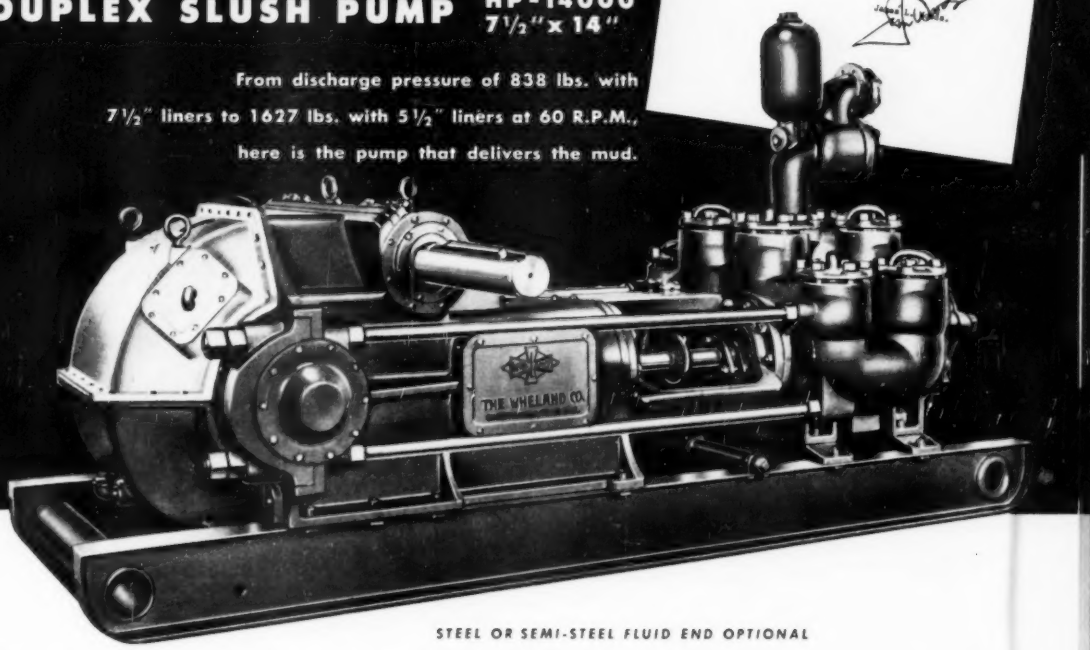
DUPLEX SLUSH PUMP HP-14000 7½" x 14"

From discharge pressure of 838 lbs. with 7½" liners to 1627 lbs. with 5½" liners at 60 R.P.M., here is the pump that delivers the mud.



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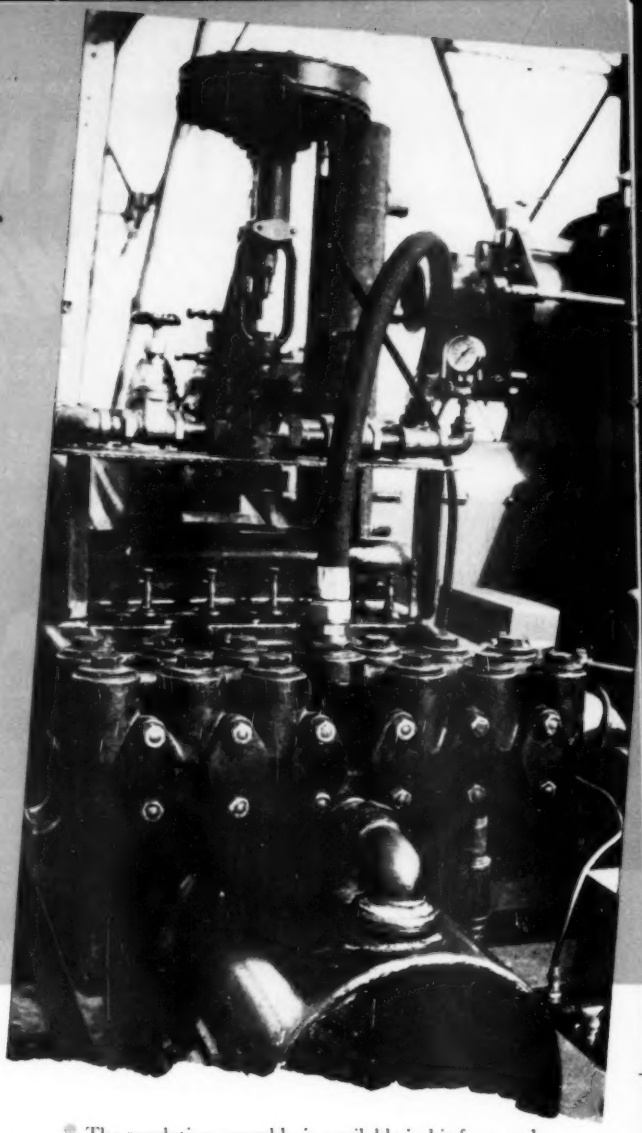

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USS "OILWELL"

UNITED STATES STEEL

Shallow Pay in Scurry Reef Area

ANOTHER pay zone, and a shallower one at that, was added to the oil prospects of the huge reef play in Borden-Scurry-Kent counties of West Texas. The J. A. Chapman Co. 6 Cogdell, in Section 716, Block 79, H&TC Survey, a little over a mile north of the south line of Kent County, on potential test flowed 1,232 bbl. through a ¾-in. tubing choke, from a pay nearly 2,000 ft. above the regular Canyon reef.

The new discovery is in the same section as the first Canyon discovery well in Kent County, and although completed in the shallower pay, would undoubtedly have made a good well in the Canyon. No announcement has been made as to whether a twin well will be drilled to the Canyon. With 7-in. pipe set through the present pay, the operator probably can wait and see. If the new pay fails to hold up, the well can still probably be carried down and 5-in. set on top of the Canyon reef at a later date.

From an elevation of 2,339 ft., the discovery found top of the pay at 4,910 ft., drilled to 4,970 ft., total depth, set 7-in. at 4,969 ft. The perforations were made at 4,906-30 ft. Flowing tubing pressure varied from 150 to 430 psi., and gas-oil raito was 201 cu. ft. The pay is either a sand stringer in a lime, or a soft spot in the lime. The lime itself is either Wolfcamp, basal Permian, or Cisco, upper Pennsylvanian.

This strike is not only important in itself, but it has another effect. It takes the Scurry reef out of the "exception to the rule class" of reefs. In most Texas areas where production is associated with reefs, the draping over the reef has usually resulted in oil accumulations in one or more beds well above the main reef. With one shallow spot now showing production in the Scurry area, the operators and their geologists will be taking another look at their hole cards. This woudn't be the first big pool where the big rush to complete wells in a rich, deep pay has resulted in the overlooking of some good shallower pays.

It's anyone's guess right now—but experience with reefs in other places would indicate that this shallow production, even if fairly widespread, will be spotty and discontinuous. Moreover, shallow pays, if found in other parts of the area, may well be in different formations over different parts of the field.

Judging from testimony by reservoir engineers and geologists before the Texas Railroad Commission recently, your guess about some things there is as good as any. They decided that Kelley and North Synder fields probably connect up as one reservoir; and they doubt that Diamond "M" and Sharon Ridge Canyon belong with the other two, but they might.

Now the reservoir engineers can sympathize with the geologists. Reefs are "hot;" but reefs are peculiar. So everyone wants to know more about what they have done in other places. But that means a search of the literature, and when the problems are on top of you, you don't have time to go hunting a needle in a haystack. In the February 1950 A.A.P.G. Bulletin, Vice President Theodore A. Link, an outstanding authority on reefs himself, suggested *(see page 293, Vol. 34, No. 2, A.A.P.G. Bulletin)* that the A.A.P.G. or Geological Society of America might make a comprehensive bibliography on reef literature a worthy subject.

Fortunately, it appears we won't have to wait for that service. It is now known that a geophysical service company undertook that task some time back as a goodwill contribution and that the finished product will be available for inspection at the Chicago convention this week. Our reports are that it is a 176-page book, with 144 pages of biblography references to geological and geophysical literature on reefs, cross-indexed by author, geographic location, geological age, and subject. Confirming previous guesses that reefs are not rare, it is said to contain references to reefs in 33 states in the United States, and in all geological ages from Proterozoic to Recent; to list over 1,000 articles by over 500 authors.

The problem of how the books will be distributed, other than those given out at the convention, has not been definitely decided. If you would like to have one of these bibliographies, the Readers Service Department of The Oil and Gas Journal will take your request and turn it over to the geophysical contractor to put on his list for distribution by whatever means is finally decided upon.

Charles. J. Deegan.

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

WEST TEXAS.—Second pay zone for Cogdell Canyon field, Kent County, has been identified as Wolfcamp, lower Permian, in Chapman & McFarlin's 6 Cogdell, in Section 716. Completion was from 144 shots at 4,906-30 ft., where it flowed at the rate of 1,233 bbl. of 43°-gravity oil a day, based on a 5-hour test through ¾-in. choke. Tubing pressure was 430-150 psi. and gas-oil ratio was 201 cu. ft. Total depth was 4,970 ft. The well is northeast of the main field and ½ mile from nearest Canyon producer. Progress Petroleum 2 Buffaloe, Section 565, north offset to its discovery completed flowing 753.6 bbl. of oil a day through 30/64-in. choke. Completion was from open hole from 6,850-6,945 ft., total depth, after 1,000-gal. acid treatment.

ROCKY MOUNTAIN AREA.—Continental Oil Co. has found oil in the Sussex sand in the fifth pool along the Sussex anticline, Wyoming, and is drilling ahead for the Lakota. The Ohio Oil Co. recovered 3,913 ft. of oil on a 30-minute drill-stem test at an extension in the Huntsman area, Cheyenne County, Nebraska. Shows of gas were found in the top of Frontier at the Trigood Oil Co.-Hamm Brewing Co. wildcat in the McCullough Peak area, Wyoming.

CALIFORNIA

Cuyama Valley May Have Fourth New Shallow Pay

LOS ANGELES.—Continued testing of Hancock Oil Co. 65-10 Hancock-Oceanic indicates a fourth, and shallower, oil discovery is in the making for Cuyama Valley. Drilled to a total depth of 2,492 ft., hole has been plugged back to 1,920 ft. and a 5½-in. liner hung at that depth with tubing run to 1,880 ft. Upon swabbing, about 107 bbl. of mud and 31 -gravity crude were recovered, but the operator has been unable to obtain flowing production.

The potential discovery, located in Section 10-11n-28w, San Luis Obispo County, is producing from a section of the Morales sand between 1,750-1,920 ft. Top of this zone was called at 1,695 ft. The prospective producer is about ⅝ mile southwest of Superior Oil Co.'s discovery in Section 2, completed earlier this month in a deeper pay for flowing production of 390 bbl. daily. The Hancock well failed to find the section which was productive in the Superior strike.

Shell Oil Co. is preparing to drill a confirmation test about ⅞ mile southeast of its recent natural gas discovery in Kings County. The pool opener, its Harvester Unit, was completed for 4,150,000 cu. ft. early in February in a gas sand at 2,802-05 ft. The producing horizon was believed to be equivalent to the first Mya sand of Trico gas field, 8 miles southwest. Location of the second well, designated the 1 Mortgage Service Co., is in NW 13-23s-21e.

Two new tests in the Tejon Ranch area of Kern County are expected to be started within the next month. Standard Oil Co. has agreed to drill the two tests on acreage held by Reserve Oil & Gas Co. The wells, at Standard's option, will be located in the south half of Section 21 or the south half of Section 29-11n-19w.

New wildcats announced include Shell Oil Co. 1 Ben Schieferle in the Balcam Canyon area of Ventura County. Located near the center of Section 16-3n-20w, the test will be some 2 miles east of South Mountain field and about 3 miles southwest of Bardsdale. In Santa Barbara County, NW 27-10n-27w, A. A. Cameron is preparing to drill the 22 Hill Bros. Location is about 1½ miles northwest of the South Cuyama field. In San Luis Obispo County, and about ¼ mile west of Russell Ranch production, Charles Holmes has staked location for 1 Well in Section 23A-11n-28w.

Near Ocean City, Washington, Union Oil Co. is continuing to test its 3 State. Drilled to a total depth of 9,344 ft., with 7-in. casing set at 9,032 ft., several possible oil horizons have been tested. Latest reports on the wildcat show the hole to be plugged back to 5,070 ft. with 2½-in. tubing landed at 4,334 ft. On tests at this plugged-back depth, the well has ben pumping some 6-15 bbl. of 39 -gravity crude daily. Location of the wildcat is in Section 15-18n-12w.

CALIFORNIA WILDCAT FAILURES

Kern County, Blackwells Corner area: Superior Oil Co. 6 O.L.C., 28-26s-19e, dry, TD 5,786 ft., elev. 736 ft.

Tejon Hills area: M. K. Doumani MK-1 Tejon Ranch, 14-11n-18w, dry, TD 822 ft., elev. 1,154 ft.

Los Angeles County, Newhall area: General Petroleum Corp. 1 Bermite, 25-4n-16w, dry, TD 5,043 ft., elev. 1,400 ft.

Devonshire area: Standard Oil Co. of California 1 Woo, 19-2n-15s, dry, TD 9,739 ft., elev. 895 ft.

San Luis Obispo County, Arroya Grande area: C. W. Colgrove 1-5 Condit, 5-32s-13e, dry, TD 4,160 ft., elev. 345 ft.

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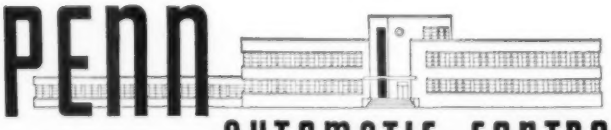

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MISSISSIPPI

New Well Preparing to Test in Ovett Field

JACKSON.—Interest has been revived in the one-well Ovett oil field of Jones County, with Ginther, Warren & Ginther preparing to perforate and test the 1 L. L. Major, 29-6n-11w, after setting production casing to 9,034 ft. Extensive sidewall coring was done at 7,675, 7,680, 6,684, 8,624 and 8,712 ft. and from core analysis, the sands appeared to carry approximately 20°-gravity oil. On drill-stem test at 7,351-81 ft., recovery was 1,860 ft. of 10.7°-gravity oil. Ovett field has only one other well pumping from sands at 13,000 ft. The Ginther well is located approximately 1 mile north of the Ovett discovery well.

In Adams County, Mississippi, Humble Oil & Refining Co. is reported to be below 10,150 ft. in the 1 James S. Giles et al, 4-7n-3w. Humble has derrick erected and is expected to move in drilling rig at the 2 Caroline Blake, 23-5n-3w. The same company is reported to be ready to move in drilling equipment at the 1 Edna Blewett Parker et al, 53-8n-2w.

George Vasen has broken the depth record in the state at his 1 Tung Oil Corp., 9-2s-11w, 4 miles northeast of Wiggins, Stone County. He is presently drilling below 16,100 ft. in the wildcat. The old depth record for the state was 15,730 ft. The Vasen test is thought to be the deepest test drilled east of the Mississippi River.

J. D. Reese is erecting pumping unit at his 1 George Armstrong, 19-5n-3w, Adams County, Mississippi, in an effort to complete the wildcat as a commercial producer. The well swabbed an estimated 50 per cent salt water and oil through perforations at 6,588-91 ft. with the amount of fluid recovery estimated to be 80 bbl.

The six new locations in Mississippi include four wildcat starts, one each in Jefferson and Madison counties and two in

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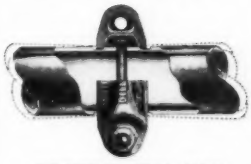

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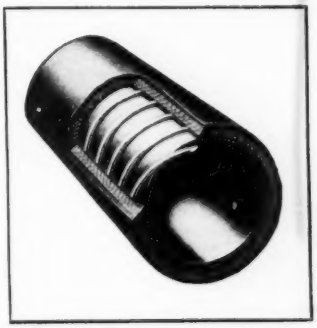

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Adams County. There were no successful exploratory tests completed, however three were reported dry, one each in Itawamba, Jefferson and Jones counties.

MISSISSIPPI WILDCAT FAILURES

Itawamba County: Walter Sistrunk 1 O. H. Evans, 16-11s-9e, dry, TD 1,771 ft.

Jefferson County: Dick Lawrence 1 J. R. Allen, 34-8n-1e, dry, TD 7,026 ft.

Jones County: Ginther, Warren & Ginther 1 Marie Black, 12-6n-12, dry, TD 9,003 ft.

N. CENTRAL TEXAS

Well Being Completed May Extend West Field

WICHITA FALLS.—A 1¼-miles northeast extension to the West field of Wichita County, or discovery, was in prospect at Hale & West 1 J. R. Ray, L. T. Dykes Survey. The well was swabbing some 50 bbl. of oil a day from the KMA Strawn sand after being shot with 110 qt. of nitro from 4,429-4,558 ft. It was swabbing about 10 ft. off bottom. Plans were to put it on the pump if it would not kick off to flow.

In Montague County, Bluff Creek Oil Co. 1 Naomi Jameson, wildcat in the S. F. Maines Survey, A-501, 1¼ miles west of Montague and about 1½ miles northeast of the Gronow field, set 5½-in. casing at 5,757 ft. and was waiting on cement. The well flowed oil in 14 minutes on a drill-stem test from 5,757-67 ft., in the conglomerate. The hole was reported full of oil after an overnight shut-in.

Four miles northwest of Bowie, The Texas Co. 1 P. E. Boedecker, Section 2,832, TE&L Survey, logged shows of oil in the conglomerate from 6,12-32 ft. A drill-stem test from 6,118-32 ft., open 2 hours, recovered 105 ft. of gas-cut mud. It drilled ahead below 6,172 ft.

H. O. Grace 1 C. E. Cunningham, wildcat 2 miles northeast of St. Jo, in the S. H. Stephens Survey, A-683, prepared to run 5½-in. casing to 3,972 ft. A drill-stem test from 3,972-82 ft., in sand, recovered 60 ft. of oil-cut mud in 90 minutes.

New exploration work in Montague County included a 7,000-ft. Bend conglomerate wildcat in the Forestburg area of southeastern Montague. This well, the first in that area for several months, is to be drilled by Konrad Sztykgold as the 1 Minnie Littell, 467 ft. from southeast and southwest lines of the G. E. Givens Survey. Location is 3½ miles northwest of the town of Forestburg, on a block of 950 acres.

W. H. Bryant, Abilene, has staked location for 1 A. J. Cox Estate, 5 miles south of Belcherville and 1 mile west of Sanders field. Location is 330 ft. out of the southwest corner of Block 117, in the Belcher Subdivision. Contract depth was 6,500 ft.

R. J. Caraway filed application to drill a 6,500-ft. test 2 miles east of Belcherville and 1 mile north of the Maguire field, as the 1 Cardwell, 1,500 ft. from east and 330 ft. from south lines of Block 31, J. Y. Castillo Survey.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) SUCCESSFUL WILDCATS

Archer County: Bridwell Oil Co. 1 Bridwell-Jackson "C," W. B. Aldridge Sur., A-2, 10 mi. NE Archer City, TD 5,120 ft., PB 4,010 ft., Strawn pay 3,978 ft., pumped 126.5 bbl. of 42°-gravity oil a day, shot 3,977-4,010 ft.

Wise County: Cities Service Oil Co. 1 S. Williamson, Blk. 4, CSL Sur., A-988, 5 mi. NW Alvord, TD 7,337 ft., elev. 959 ft., Ellenburger 7,212 ft., pay 7,277 ft., swabbed 265 bbl. of 39.5°-gravity oil a day, GOR 306 cu. ft., perf. 30 shots 7,277-82 ft.

Young County: E. S. Brashear 1 S. R. Jeffery, Blk. 51, TE&L Sur., ½ mi. W Orth, TD 863 ft., pay 858 ft., pumped 65 bbl. of 37°-gravity oil a day.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) WILDCAT FAILURES

Archer County: Consolidated Oil Co. et al

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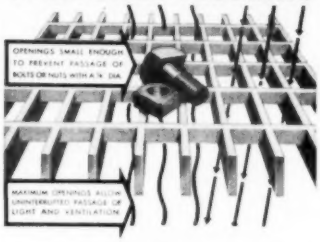
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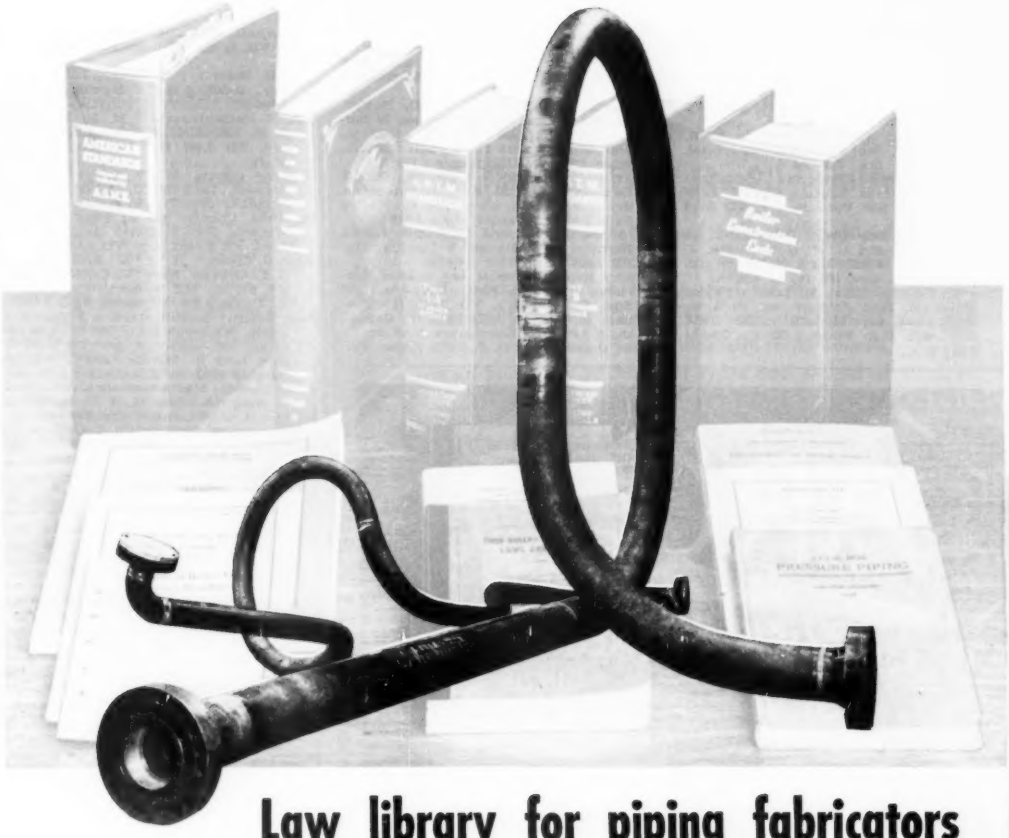

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2 Virgin Seay "C," Blk. 110, John W. Harris Subd., 4 mi. W Archer City, dry, TD 1,551 ft.

G. E. Kadane & Sons 1 Mack Prescott, McKinney & Williams Sur., A-309, 2 mi. SE Dundee, dry, TD 4,596 ft., elev. 673 ft., Gunsight 1,805 ft.

Brown County: A. C. Cardwell 1 N. H. Touchstone, Sec. 77, HT&B Sur., 4 mi. NW Owens, dry, TD 820 ft.

Callahan County: Trumpter Petroleum Corp. 3 Herman Betcher, Sec. 66, BOH Sur., 5 mi. NW Putnam, dry, TD 2,213 ft.

Clay County: Dub-Wood Drilling Co. 1 Claudie M. and C. E. Guthrie fee, J. Floyd Sur., A-150, 5 mi. N Byers, dry, TD 1,895 ft., elev. 880 ft., no shows.

Coleman County: Harry L. Todd 1 Taylor Motor Co., John Johnson Sur., 45, 3 mi. W Coleman, dry, TD 3,022 ft., elev. 1,816 ft., lower Palo Pinto 2,432 ft., Caddo 2,895 ft.

Comanche County: Burdell Oil Co. 1 Lee Drennan, Sec. ETRR Sur., 9 mi. NW Comanche, dry, TD 2,952 ft., elev. 1,398 ft., Mississippian 2,872 ft., Ellenburger 2,925 ft.

Clemens, Roche et al 1 E. D. Holden, Sec. 44, ET Sur. A-1287, 3½ mi. N Sidney, dry, TD 3,540 ft., elev. 1,416 ft., Marble Falls 2,615 ft., Barnett 2,900 ft., shale 2,928 ft., Ellenburger 3,172 ft.

T. W. Doswell 1 W. D. Chapman, Sec. 33, Lampasas CSL CSL, 6 mi. W Comanche, dry, TD 2,884 ft., elev. 1,450 ft., Marble Falls 2,487 ft., Barnett shale 2,878 ft.

E. J. McCurdy, Jr. 1 J. W. Dalton, Joseph Herndon Sur., 3½ mi. S Lamkin, dry, TD 3,625 ft.

Henry Replin 1 Fannie Lee Grimes, Sincleton Thompson Sur., A-927, 6 mi. SW Sipe Springs, dry, TD 3,046 ft., elev. 1,526 ft., Marble Falls 2,630 ft., Barnett shale 2,983 ft., Ellenburger 3,042 ft.

Cooke County: M. W. Blair 1 Anton Felderhoff, Blk. 14, Thomas Scott Sur., A-900, ½ mi. E Muenster, dry, TD 2,002 ft.

D. H. Bolin 1 C. I. Miller, J. M. Sadler Sur., A-902, 2 mi. E Bulcher, dry, TD 2,496 ft.

R. B. Hollandsworth 2 M. M. Thomason, T. P. Bell Sur., A-52, 1½ mi. SE Leo, dry, TD 2,467 ft., conglomerate 2,413-49 ft.

Eastland County: W. W. Sawyers 1 O. C. Stewart, 130-3-H&TC, A-1834, 3 mi. N Scranton, dry, TD 690 ft.

Hamilton County: G. E. Fagg 1 T. W. Winters, Sec. 2, David Andrews Sur., 3 mi. NE Evant, dry, TD 1,100 ft.

Haskell County: R. H. K. Drilling Co. 1 S. L. Griffith, Mary W. Crittenden Sur. 214, 6½ mi. NE Weinert, dry, TD 5,979 ft., Caddo 5,329 ft., Marble Falls 5,597 ft.

Jack County: Russell Maguire 1 Nannie E. Davis, Washington Co. RR Sur., A-904, 10 mi. SE Jacksboro, dry, TD 6,500 ft., elev. 1,042 ft., Marble Falls 5,452-58 ft., Barnett 6,097 ft., Ellenburger 6,298 ft.

Jones County: Max Eversberg, Jr. 1 Minnie L. King "A," Sec. 17, J. R. Carruthers Sur., 1 mi. S Lueders, dry, TD 1,995 ft.

West Central Drilling Co. 1 G. L. Goza, A. Wagner Sur. 206, 8 mi. SW Anson, dry, TD 3,015 ft., elev. 1,711 ft.

Montague County: Bolin Oil Co. 1 J. A. Fooshee, Jose Olibarri Sur., A-579, 4 mi. S Nocona dry, TD 5,854 ft., elev. 963 ft.

Palo Pinto County: H. R. Montgomery 1 W. C. Bridges, John F. Smith Sur., A-410, 9 mi. W Graford, dry, TD 2,405 ft., elev. 1,070 ft., Palo Pinto 475 ft., Strawn 700 ft.

Shackelford County: Starr Oil & Gas Co. 3 J. D. Windham "H," 80-12-T&P, 15 mi. SW Albany, dry, TD 1,305 ft., sand with oil show 1,285-86 ft.

Taylor County: Taubert Drilling Co. 1 S. L. Bacon, Sec. 255, H&TC, 5½ mi. NW Shep, dry, TD 4,305 ft., elev. 2,354 ft., reef 4,298 ft.

Throckmorton County: Grisham-Hunter Corp. 1 Murphy-Kunkel, Sec. 652, TE&L Sur., A-267, 14 mi. S Throckmorton, dry, TD 4,842 ft., Ellenburger 4,822 ft., DST had free oil at 4,618-28 ft.

Young County: H. D. Egger 1 B. W. King "A," L. W. Ross Sur., A-2220, 4 mi. N Loving, dry, TD 3,558 ft.

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APPALACHIAN FIELD

Wirt County Wildcat Proves a Failure

PITTSBURGH.—In Tucker district, Wirt County, West Virginia, Glen W. Roberts 1 H. W. Stephens, elevation 1,070 ft., resulted in a dry hole at 5,402 ft. (See wildcat failure paragraph below for detailed information). This operator has shut down operations at 3,670 ft. in his 1 Forrest Daugherty, elevation 1,066 ft. United Fuel Gas Co. 6552 R. J. Moore, elevation 994 ft., topped the Corniferous lime at 5,175 ft. and ran 7-in. casing at 5,204 ft. In Steele district, Wood County, Hope Natural Gas Co. 9409 A. J. Holbert, elevation 760 ft., reached the Corniferous lime at 4,881 ft. and ran 7-in. casing at 4,903 ft. A good shallow sand gas well was noted in DeKalb district, Gilmer County, when Hope Natural Gas Co. 9404 E. L. Valentine, elevation 1,070 ft., gaged 1,225,000 cu. ft. of gas after shot in the Berea sand. Total depth was 2,312 ft.

In Napier Township, Bedford County, Pennsylvania, South Penn et al, Snee & Eberly 1 Jesse B. Miller, elevation 1,666 ft., is still in a fishing job encountered at 7,255 ft. In Georges Township, Fayette County, Orville Eberly et al 1 N. E. Murphy, elevation 2,560 ft., is drilling at 7,596 ft.

WEST VIRGINIA WILDCAT FAILURE

Wirt County, Tucker district: Glen W. Roberts 1 H. W. Stephens, elev. 1,070 ft., dry, Corniferous lime 5,272 ft., Oriskany sand 5,391 ft., show of gas 5,396 ft., water 5,396-5,402 ft., TD 5,403 ft.

OKLAHOMA

Lincoln County Wildcats Showing for Production

DISCOVERY of a new Skinner sand pool located 3 miles west of Wellston, western Lincoln County, appears to have been made by Coronado Oil Co. at its 1 Kriel, SW SW NW 20-14n-2e. Skinner sand was found at 4,867 ft. A drill-stem test taking in the top 10 ft. resulted in a recovery of 800 ft. of clean oil and 2,270 ft. of oil-cut mud. Tester was open 60 minutes. Hole was drilled to 5,000 ft. and 5½-in. oil string run to 4,929 ft. The test originally was projected to the Wilcox sand, expected around 5,650 ft. The location is only a mile east of the Oklahoma County line.

Another Lincoln County wildcat, Creekmore-Rooney and associates 1 James, NE NE SE 32-14n-6e, 2½ miles houtheast of the Southeast Davenport pool, has found excellent saturation in the Prue sand, topped at 3,061 ft. Solid, saturated sand was cored at 3,064-86 ft. (total depth). Casing (7-in.) has been run to the top of the sand for testing.

Kingwood Oil Co. Murphy, SW SW SE 27-18n-1e, which is opening a new Bartlesville sand pool 9 miles southwest of Stillwater, Payne County, swabbed 29 bbl. of oil natural in the first 12 hours. Since then the sand, open at 4,776-4,829 ft., has been shot with 80 qt. of nitro, and at lastest report was cleaning out to resume testing.

Cities Service Oil Co. 1 Koehn, NE SE SE 8-17n-1w, an eastward extension test for the Guthrie pool, Logan County, yielded 31 ft. of free oil and 38 ft. of oil-cut mud in a drill-stem test of Misener sand. Interval tested was at 4,930-35 ft. Hole is drilling ahead.

Another gas pay zone, the Booch sand, has been opened in the East Bearden pool, Okfuskee County. Davidor & Davidor 1 Curry, SW SW NE 14-10n-9e, the discovery well, was completed with a potential of 12,000,000 cu. ft. of gas daily. Sand was topped at 2,717 ft. Production is from casing perforations at 2,716-28 ft. Hole had been drilled to a total depth of 4,143 ft. in the Wilcox and casing had been cemented on bottom. The Wilcox, Dolomite, Hunton, Cromwell and Gilcrease zones also were tested. The Hunton lime and Gilcrease sand are other productive zones in the pool.

Stanolind Oil & Gas Co. 1 Tucker, SW NW NW 25-1s-4w, which extends production ¾ mile southwest and proves a new pay zone for the Sholem Alechem pool, Stephens County, swabbed 225 bbl. of 23° oil in 24 hours after reperforating casing at a slightly higher level in the Springer C sand than that previously tested. Latest test was through perforations at 5,632-62 ft. Previous tests were of an interval at 5,668-86 ft., where the well swabbed 99 bbl. of oil with some water in a 12-hour period. The well now is being completed in the higher interval.

OKLAHOMA SUCCESSFUL WILDCATS

Noble County: Sinclair Oil & Gas 2 Sullins, NE NW NE 12-23n-1w, flowed 278 bbl. of 40.6°-gravity oil per day from Red Fork at 4,11-27 ft., TD 4,468 ft.

Oklahoma County: Peppers 1 McKee est., NW NE NW 16-12n-2w, pumped 95 bbl. of oil per day from Cleveland at 5,654-72 ft., TD 7,112 ft.

Payne County: Berry 1 Davenport, SE SW NE 34-18n-6e, pumped 10 bbl. of oil per day from Layton at 1,868-76 ft., TD.

Sequoyah County: Lohman & Johnson 1 Cook, NW NW 8-12n-24e, gaged 1,125,000 cu. ft. of gas per day from sand at 1,120-85 ft. and lime at 770 ft., TD 1,740 ft.

OKLAHOMA WILDCAT FAILURES

Comanche County: Ward & McCullough 1 Gipson, NW NW NE 14-1n-13w, dry, TD 1,664 ft.

Garfield County: Josaline Producing Co. 1 Steele, NW NW SE 13-24n-6w, dry, TD 5,440 ft.

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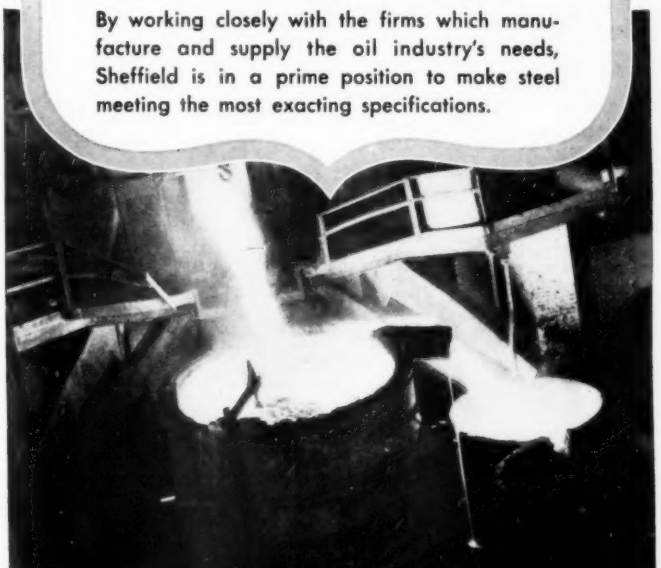

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Grady County: Joe Ray 1 Baskin, NE NE NE 2-3n-6w, dry, TD 6,602 ft.

Hughes County: Manahan Oil Co. 5-S McGirt, E/2 SW SW 1-9n-8e, dry, TD 6,147 ft., (geological test in Olympic field, to be used as water supply well).

Jefferson County: Sun Drilling 1 Howard, SW NE NW 24-6s-5w, dry, TD 3,675 ft.

Lincoln County: Republic Natural Gas 1 Huckabay, NW SW SW 9-15n-2e, dry, TD 4,680 ft.

Cummings-McIntyre 1 Cooper "A," NW NW NW 19-17n-4e, dry, TD 4,179 ft.

Payne County: Portable Drilling Co. 1 Bennett, NW NW SW 10-17n-4e, dry, TD 3,946 ft.

Pittsburgh County: Consolidated Gas Utilities Corp. 1 Alford, C NW NE 30-7n-14e, dry, TD 5,508 ft.

Seminole County: Manahan Oil Co. 1 Whitfield, NE SE SE 27-7n-7e, dry, TD 2,736 ft.

Sadler 1 Johnson, NW SW NE 18-8n-8e, dry, TD 3,418 ft.

Williams-Copeland, Inc. 1 Grayson, SW SE NE 30-9n-7e, dry, TD 4,295 ft.

Sequoyah County: Lohman & Johnson 1 Grey, C NE NW 7-12n-24e, dry, TD 1,753 ft.

W. R. Gourley 1 Collins, SW NW SW 7-11n-24e, dry, TD 1,400 ft.

TEXAS GULF COAST

Two Gas Sands Found on Flank of Millican Dome

HOUSTON—Marshall Stone and C. H. Bass have found gas production in the Queen City sand and also in the Wilcox on the north flank of the Millican dome, Brazos County. The operator's 1 Wharton Weems, J. M. Barrera Survey, Abstract 67, flowed an estimated 15,000,000 cu. ft. of gas daily from the Wilcox at 3,101-09 ft. New pay was opened in the Queen City section, and through perforations at 2,611-16 ft. the well flowed an estimated 18,000,000 cu. ft. of gas daily.

General Crude Oil Co. has completed the 1 Kirby Lumber Co. for a new oil discovery in the Kountze area of Hardin County. Through perforations at 8,248-52 ft. the well flowed 390 bbl. of oil daily on potential through a $\frac{1}{8}$-in. choke. Gravity was 35.8° and tubing pressure was 2,150 psi. This well, located in the H. A. Hooks Survey, Abstract 871, is 2,000 ft. northeast of the 1 Ester Hooks, recently brought in as a gas-condensate producer through perforations at 8,258-63 ft. There was oil saturation evident in the 1 Hooks, but gas-oil ratio was too high. It is now shut in and may be reworked later to bring in expected oil production from this well also.

American Republics Corp. and Houston Oil Co. of Texas 1 O. C. Nelson League fee, O. C. Nelson League, Abstract 40, 8 miles north of Silsbee, Hardin County, was perforated at 6,943-56 ft. and flowed 33 bbl. of fluid per day, by heads, then died. Fluid was 79 per cent oil and 21 per cent water. Operators are assured of a new discovery, and will move in workover rig and reperforate for completion attempt.

Callery & Hurt has drilled to 3,598 ft. in their Boling Dome wildcat, the 2 John Kasparek, Simon & Miller League 2, Fort Bend County, and cemented 5½-in. string on top of the sand for testing through open hole. The well flowed 88 per cent oil and 12 per cent salt water through 12/64-in. choke, with tubing pressure of 150-175 psi. Operators will continue to test the venture.

TEXAS GULF COAST (DISTRICTS 2 AND 3) SUCCESSFUL WILDCATS

Austin County: New pay at New Ulm—McCarthy Oil &Gas Corp. 1 Herman Blezinger et al., Felix Wright Heirs Sur., A-314, 4½ mi. E of New Ulm, TD 9,461 ft., top pay 8,978 ft., perf. 8,978-88 ft., IP: 271 bbl. oil per day, 9/32-in. choke, TP 500 psi., GOR 815; 40.2°-gravity, dual completion, top pay 9,325 ft. (new sand) perf. 9,325-40 ft., IP: 150 bbl. condensate per day plus 25,000,000 cu. ft. of gas.

Hardin County: New oil pool—General Crude Oil Co. et al 1 Kirby Lumber Co., H. A. Hooks Sur., A-871, 2 mi. W of Kountze, Tex., TD 8,500 ft., top pay 8,248 ft., perf. 8,248-52 ft., IP: 390 bbl. oil per day, ⅛-in. choke, 35.8° gravity, TP 2,150 psi.

Liberty County: New pay at Hull—The Texas Co. 8 Armelin fee, S. Wickliff Sur., TD 7,168 ft., top pay 7,032 ft. (new pay) perf. 7,005-32 ft., IP: 190 bbl. oil per day, 9/64-in. choke, TP 1,100 psi., 34.6° gravity, dual completion, top pay 6,442 ft., perf. 6,448-54 ft., IP: 130 bbl. oil per day 10/64-in. choke, CP 400 psi., 33.3° gravity.

TEXAS GULF COAST (DISTRICTS 2 AND 3) WILDCAT FAILURES

Calhoun County: Fifteen Oil Co. 1 State of Texas Tr. 199, San Antonio Bay (Espiritu Santo Bay), 9½ mi. SW of Port O'Connor, dry, TD 5,745 ft.

Chambers County: Brown & Wheeler 1 W. F. Mayes et al, E. Dorr Sur., A-74, 1¾ mi. S of Lost Lake field, dry, TD 7,745 ft.

R. A. Irwin and J. R. Buck 1 Ben Dutton, Joseph Lawrence Sur., A-168, 6 mi. W of Anahuac townsite, dry, TD 7,022 ft.

Jackson County: Hangamer Investment Co. 1 Pridgen & Donnelly, Block 13, McCrory's Subd. of Crews Ranch, Raphal Solis Sur., A-73, dry, TD 6,715 ft.

Live Oak County: Kennedy & Lynton 1 J. S. Hall, BS&F Sur., A-96, dry, TD 4,500 ft.

Ryan, Hays & Burke 1 Georgia Stolte, James Ingram Sur. 120, A-261, 2 mi. NW of Nell, dry, TD 8,005 ft.

Newton County: Fullerton Oil Co. 1 West & White, Robert Goodwin Sur., A-4, 3 mi. NW of Sabine production, dry, TD 10,710 ft.

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Polk County: Dr. S. H. Bergman 1 Ernest Cocker, John T. Pinchney Sur., A-63, 2¼ mi. N of Goodrich, dry, TD 3,902 ft.

Refugio County: Daugherty & Kidd et al 1 P. R. Nichols, Edmond S. John Sur., A-39, 5 mi. NW of Refugio field, dry, TD 6,022 ft.

Selby-Walker Corp. and Ryan, Hayes & Burke 1 Paul Zabel, Sec. 12, Johnson & Pugh Subd. of Bonnie View Ranch, 1½ mi. S of Bonnie View field, dry, TD 6,505 ft.

MICHIGAN

Socony-Vacuum Richfield in Dundee Pool

MOUNT PLEASANT. — Socony - Vacuum Oil Co. announced this week that rig will be built immediately for the first Richfield, 5,000-ft. oil test in Billings field, Gladwin County. The field, discovered by Socony in 1949, is being produced from the Dundee lime at an approximate depth of 3,550 ft.

This first deeper horizon test will be in the SW NW SW 2-17n-1e, on the west side of the developed pool, and apparently on the top of the Dundee structure as it has been outlined by drilling to date. The well will be drilled all the way to the objective with cable tools. E. M. Shields is the drilling contractor.

The first follow-up venture to The Superior Oil Co.'s Butman field Richfield zone discovery, Butman Township, Gladwin County, was scheduled to test Richfield pay zone this week. This well, Robert Bond's 1 Krivestky, NE SE NW 12-20n11w, diagonal northeast 40-acre offset to the discovery, was being rotary-drilled below 4,807 ft. near Richfield porosity sections earlier this week.

Following a public hearing of the Supervisor of Wells and the State Oil Advisory Board in Lansing, spacing orders establishing diagonal 20-acre drilling units in New Bishop Traverse field, Newaygo County, and in White River Dundee field, Muskegon County, were issued and became effective April 20. This allows wells to be drilled on the northwest and southeast diagonal locations on each quarter-quarter section. Another spacing rule announced was the abrogation of a 20-acre order in the Elmwood Dundee area, Tuscola County, which was placed in effect December 1, 1949. Drilling in this area will now be permitted on regular 10-acre locations.

MICHIGAN SUCCESSFUL WILDCATS

Muskegon County, White River Township: Kenneth A. Fox 1 Gee, SE SW NE 15-12n-18w, Dundee 2,050 ft., 40 bbl. (settled), 35 per cent water, TD 2,056 ft.

Newaygo County, Garfield Township: Sun Oil Co. 1 Wood, NW SW SE 19-12n-13w, Traverse 2,223 ft., 66 bbl. (pinched), TD 2,226 ft.

MICHIGAN WILDCAT FAILURES

Allegan County, Allegan Township: Pascal F. Broughton 1 Wetmore, SE NW NE 10-2n-13w, Traverse 1,480 ft., dry, TD 1,530 ft.

Casco Township: Norman L. Stevens 1 Brandt, NW NW SW 26-1n-16w, Traverse 1,120 ft., dry, TD 1,121 ft.

Bay County, Pinconning Township: Don Rayburn 1 Michalski & Boetefuer Comm., SW SE NE 33-17n-4e, dry in Richfield (?), TD 4,795 ft.

Gladwin County, Secord Township: Basin Oil Co., Ogma Development Co., and W. B. Stewart A-1 State-Secord, SW SW NW 16-19n-1e, Dundee 3,419 ft., dry, TD 3,495 ft.

Kent County, Algoma Township: Fisher-McCall Oil & Gas, Inc. 1 Lundin, NE NE SW 13-9n-11w, Traverse 2,296 ft., dry, TD 2,346 ft.

Tyrone Township: James J. McGerr, Trustee 1 Dyer, NE SE SE 27-10n-12w, Traverse 2,344 ft., dry, TD 2,351 ft.

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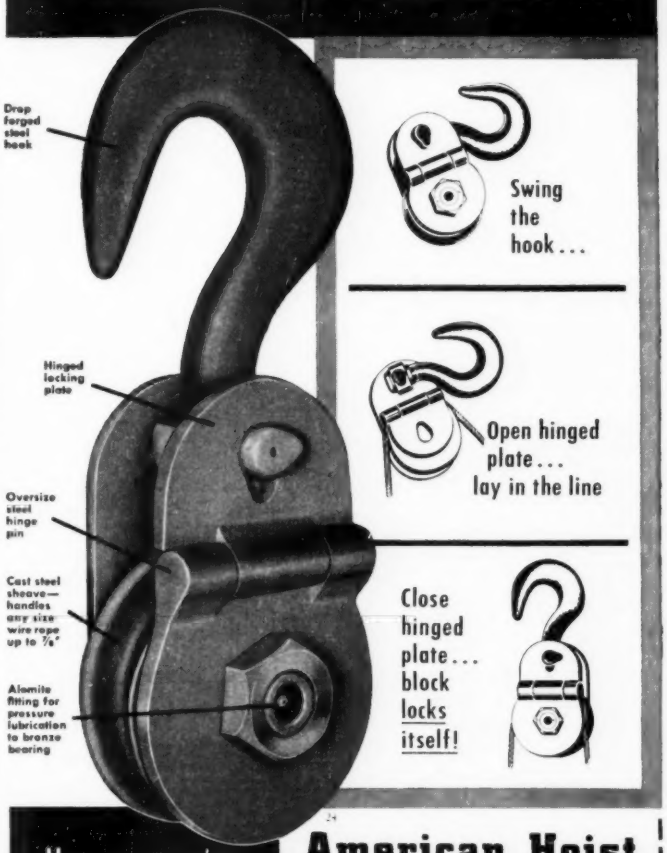
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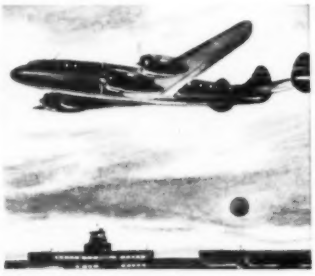

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SOUTH LOUISIANA

Magnolia Building Tanks For Offshore Discovery

NEW ORLEANS. — Magnolia Petroluem Co. is building tanks for its offshore discovery, the A-2 State Lease 693. This well has proven to be one of the best oil producers yet discovered offshore. Through perforations at 11,648-58 ft., using 12/64-in. choke, the well tested 614 bbl. of 35.8°-gravity oil, with flowing pressure on the tubing of 2,565 psi. Through a 14/64-in. choke, the well made 788 bbl. of 35.8°-gravity oil on a 3-hour test, with a flowing pressure on the tubing of 2,510 psi. Operators found the well actually bottoms in Block 126, and the fee name has been changed to A-1 State Lease 694.

Meanwhile, off St. Mary Parish, Magnolia is reported to have logged a new oil sand from 7,621-31 ft. in the A-2 State Lease 693. Operators are now drilling below 11,424 ft.

Pure Oil Co. is reported to have cored a new oil sand in the A-2 State Lease 833, wildcat approximately 18 miles southeast of Marsh Island, off St. Mary Parish. The new sand was cored in the interval of 7,621-831 ft. Operators are presently drilling below 11,100 ft.

Shell Oil Co. has abandoned testing the lower three sections and are moving up the hole in the 1 State Lease 1,008, South Pass area, off Plaquemines Parish. The lower sections initially showed a good flow of oil. However, rising gas in proportion to the oil in combination with an increasing drop in pressure caused operators to abandon testing. The lower sections have now been plugged and it is reported that operators will perforate around 6,500 ft.

The Texas Co. has cleaned out hole in the 1 Dan B. Morgan et al Unit 1 to 10,613 ft., and is now preparing to sidetrack around the fish at 10,272 ft. The well was originally drilled to 11,261 ft. before operators stuck drill pipe. This well is located in Section 21-9s-3e, on the southeast Dutchtown prospect and is projected to 11,000 ft.

The 16 new locations include two wildcat starts, one each in Calcasieu and Cameron parishes. There were no successful exploratory tests completed; however, three were reported dry, one each in Allen, Orleans and St. Mary parishes.

SOUTH LOUISIANA WILDCAT FAILURES

Allen Parish: Pure Oil Co. 1 Industrial Lumber Co., 33-3s-5w, 1½ mi. NE Tennile townsite, dry, TD 8,607 ft.

Orleans Parish: Stanolind Oil & Gas Co. 2 E. B. Norman, 18-13s-24e, 4 mi. E-SE of Gretna, dry, TD 13,505 ft.

St. Mary Parish: Magnolia Petroleum Co. B-2 State Lease 670, Block 58, offshore, dry, TD 11,544 ft.

EASTERN TEXAS

Fair Field Edge Well Extends Paluxy Pay

DALLAS.—On the north edge of Fair field, Kaufman County, R. W. Fair 5-B Wynne, Spikes Survey, extended production from the Paluxy and was ready for completion. On a 10-minute drill-stem test from 4,900-20 ft., the well yielded 880 ft. of clean oil, plus 120 ft. of heavily oil-cut mud. Seven-inch casing was set at 4,939 ft., 1 ft. off bottom, for completion. A later report indicated the well had flowed 110 bbl. of oil in 11 hours, through 6/64-in. choke.

The same operators made location for the 3 Wynne, on a 150-acre tract in the B. F. Newman Survey, which was 500 ft. northwest of the 1 Wynne, discovery well.

Sinclair Oil & Gas Co. 1 Tommie Lukenbill, John C. Robertson Survey, A-819, short northeast extension to the Bud Lee field of Smith County, was perforated with 72 holes from 7,578-96 ft. When the hole was swabbed it yielded fresh water, then about 2 bbl. of oil an hour. Pump was being installed for completion tests.

Unofficial information on B. B. Orr 1 Childress, 1 mile north of Pine Mills in the West Walker Survey, indicated a possible extension for the Pine Mills field. Total depth was said to be around 5,600 ft., in the Woodbine.

E. W. Jarman and others 1 Mrs. Lola Garrett, Falls County wildcat in the M. Hunt Survey, 1½ miles west of Kosse, abandoned plans for drilling ahead to the Pettit and had 5½-in. casing set at 4,154 ft. to test in the Rodessa. Total depth was 5,568 ft. At last report, plug had been drilled, the hole cleaned and a drill-stem test was to be made in open hole from 5,500-25 ft., where porosity and shows of gas-distillate were logged. Other sections scheduled to be tested included the Buda lime from 3,494-3,535 ft., and the Edwards lime from 3,994-4,100 ft.

Voth Brothers Drilling Co., Muenster, Tex., staked a location for a Denton County wildcat, as the 1 A. B. Holt, 1,500 ft. east and about 950 ft. north of the R. Prather Survey, A-1,021, but in the H. Tierwester Survey, A-1,241. The 1,800-ft. rotary test is ½-mile west of Sanger and 3 miles east of the South Bolivar area.

EAST TEXAS (DISTRICTS 5, 6 AND 6-P) WILDCAT FAILURES

Denton County: E. B. Fletcher 1 H. K. Armstrong, BBB&C Sur., A-198, 1½ mi. W Bolivar, dry, TD 1,892 ft., elev. 691 ft.

Hill County: Joseph Thompson 2 Easter Doherty, E. L. Hale and N. T. Roberts Sur., 2½ mi. NE Mount Calm, dry, TD 1,405 ft. in Woodbine.

Wood County: B. F. Phillips 1 Mary Saner,

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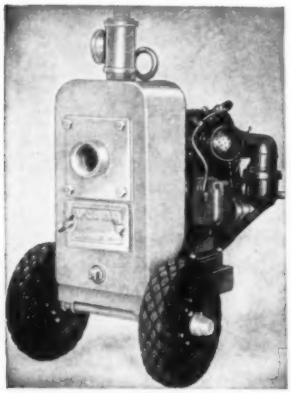

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CANADIAN FIELDS

Stettler Area Gasser To Be Tested for Oil

CALGARY.—The Stettler area well that flowed natural gas in substantial volume from the Lower Cretaceous last weekend has shown oil encouragement in that same formation, and officials state that crew is now running casing preliminary to perforating and further testing. The well, Laguerre-Pyramid-Edwards 1, about 95 miles north of Calgary, is in LSD 12, 14-38-21w4, ¼ mile south of last year's "wet gas" Lower Cretaceous discovery, Picadilly-Interleduc Edwards 1.

Latest drill-stem test of the Lower Cretaceous interval 4,453-73 ft. gave a good initial blow, with gas reaching the surface 10 minutes after the valve was opened. Fluid recovery during the 1-hour test consisted of 90 ft. of oil-cut mud, 470 ft. of clean oil, and 2,940 ft. of salt water. The oil is sweet crude, with gravity about 32° A.P.I.

Previous test from 4,333-40 ft. gave natural-gas flow rate of 5,000,000 cu. ft. daily, with a flowing pressure of 1,100 psi. The lower sand, which gave the oil encouragement, was believed to have been entered around 4,356 ft.

On the basis of Schlumberger log and core analysis it is believed that the oil-water interface is at 4,368 ft. Casing is now being run, and crew will perforate above the water line and then run further tests in an effort to further evaluate the find.

Bear Oil Co., Ltd., has completed its natural-gas discovery well in North central Alberta, after running an open-flow test and rating gas at around 4,750,000 cu. ft. daily. The well has been capped, pending a market for its product.

The gas well, 1 Bear-Brandi, LSD 9, 23-66-22w4, completed at 2,684 ft., flowed natural gas from the D1 zone of Devonian during drill-stem test of interval 1,708-38 ft. Hole was carried down to D3 equivalent but was found water bearing, so crew plugged back to D1, set casing, perforated, and ran potential test.

Brandi 1 is located about 82 miles northnortheast of Edmonton, in the Athabaska area.

The Trend - Royalite - Bolloque 1 Lake, wildcat, in LSD 8, 22-64-26w4, about 65 miles north of Edmonton, has abandoned the Devonian objective and is preparing to test upper gas shows. Natural gas in various volumes showed in a series of drill-stem tests around 2,100 ft. and between 2,800 and 2,900 ft. The combined flow on drill-stem tests indicate a large gas well will be obtained.

The well was drilled to 3,880 ft., and a plug was set from 3,575 to 3,400 ft., prior to setting 7-in. casing at 3,017 ft. Perforating and testing of the gas sands is expected to begin early next week.

The potential gas well is a joint operation of Trend Petroleums, Ltd., of Toronto and Royalite Oil Co., Ltd., of Calgary. Imperial Oil, Ltd., has a 25 per cent interest in the acreage spread, but no interest in the well.

Nine wells completed in Alberta during the past week, boosting total completions to 206 since the beginning of this year. The list now stands at: 138 oil wells, 7 gas wells, of which 6 are discoveries; and 61 dry holes. This week brought five oil producers, two gas wells, and two failures.

Redwater accounted for the five oil wells, all drilled by Imperial Oil, Ltd., discoverer of the field. Redwater also yielded a dry hole, an extension effort failure drilled by the "Pacific Group" of companies.

A Devonian gas discovery well completed in the Athabaska area of North Central Alberta ran potential test and rated flow of 4,750,000 cu. ft. daily. The well, owned by Bear Oil Co., is now capped. The other gas well was in the Bow Island area, drilled by Canadian Western Natural Gas Co., to augment its gas supply.

The lone exploratory failure during the last 7 days was drilled by Leberta-Redwater Oils, Ltd., near Gibbons, on an Imperial farmout.

UNSUCCESSFUL WILDCAT

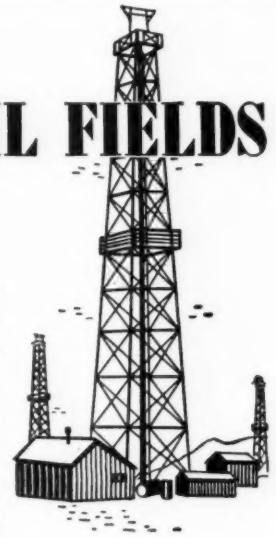
Leberta-Gibbons 1, LSD 9, 21-56-22w4, TD 3,675 ft.

EASTERN CANADA

CHATHAM.—An important gas development is reported in Payne pool, Moore Township, Lambton County, where Imperial 4 Thomas Trapp, 2,200 ft. south of the Payne discovery well, encountered gas around 1,950 ft. Imperial-Payne 1, drilled last summer, is ranked as Ontario's most important gas producer, with a flow close to 40,000,000 cu. ft. Two later tests by Imperial Oil, 2 and 3, both more than 3,000 ft. north of the discovery, finished as dry holes. Imperial 4 was at 1,950 ft. when the tools were lost in the casing. Closed in over night, the gas accumulation next morning blew the toggle out, damaging the casing. Preliminary tests indicated a 500,000-cu. ft. flow, but the hole will likely be deepened.

On Pelee Island, in Lake Erie, south of Essex County, Lake Erie Oils 1 (on the east side of the island offsetting a well drilled in 1907) is below 600 ft. with strong gas indications. Tests in this area more than 40 years ago encountered some small commercials of oil and gas at comparatively shallow depths.

First in
CANADA'S OIL FIELDS



Alberta today is one of the most active areas of oil exploration in the world with almost double the number of producing wells and output than a year ago. The Royal Bank, with 57 branches in Alberta, opened its branch in the oil field territory in Turner Valley in 1928 and followed with branches in Leduc, Devon and Redwater as development expanded. We know the oil fields and the men responsible for the development.

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PERMIAN BASIN

Reef Wells Get Better Potentials

MIDLAND.—Completion potentials have been pushed upward steadily in the Canyon reef wells of Scurry, Borden and Kent counties. This week George P. Livermore, Inc. 1 Reinecke, discovery well of North Vincent field, southwest Borden County, washed the pay section from 6,754-98 ft. with 500 gal. of mud acid, then treated with 3,000 gal. of regular acid, and on repotential test rated a daily flow of 5,492 bbl. of oil. The 24-hour potential was calculated from an actual flow of 1,373 bbl. of clean oil in 6 hours, through 1¾-in. opening on 2½-in. tubing. The well was originally completed for 1,430 bbl. of oil, through ¾-in. choke. Operators said the acid had cleaned out the mud which the pay section had absorbed while drilling.

Location has been made for a long north offset to Caroline Hunt Trustee Estate 1 J. W. Young, recently completed reef discovery northwest of Clairemont. The new well is General Crude Oil Co. and Percy Jones 1-166 J. W. Young, located 760 ft. from south and 660 ft. from west lines of the northeast quarter, 166-G-W&NW Survey. Location is 2,860 ft. north of the Hunt well.

Other locations in the area are: Hunt 2 Young, located 2,560 ft. from north and 1,720 ft. from the east lines of Section 145, about ½ mile south of the discovery; Nelson Bunker Hunt Trust Estate 1 Mary Couts Burnett, 1,110 ft. from north and 467 ft. from east lines of Section 3, D. R. Stout Survey, west offset to the discovery.

W. N. McFarlin, Wichita Falls, has made location for an 8,000-ft. wildcat 1 mile northeast of General Crude's 1-A Percy Jones, Strawn discovery just southwest of Clairemont. It is the 1 Brady Barley, 2,537 ft. from west and 2,539 ft. from south lines, 10-98-H&TC, Lot 20, Block 28, in the city of Clairemont.

Lewis T. Lohman 1 Mrs. Josie Faye Peck, Peck field test offsetting General American Oil Co.'s discovery, planned to set 5½-in. casing at 10,328 ft., in the top of the Pennsylvanian, before coring ahead. According to reports, if commercial production is developed in that formation the well may be completed there instead of going to the Ellenburger as originally planned. The well, in 20-41-4S-T&P, topped the Pennsylvanian at 10,025 ft., by samples, which was slightly low to the discovery.

One location west of the Lohman well, Trebol 1 Peck was drilling below 10,270 ft. in Pennsylvanian limestone. Sinclair Oil & Gas Co. 1 June T. Sanders, north offset to the discovery, in Section 16, was below 8,879 ft. in lime and shale. General American 1-D Peck, east offset to the discovery, and slightly north, was drilling below 9,945 ft. It was scheduled to the Devonian.

In west central Midland County, Magnolia Petroleum Co. 2 Roy Parks, NE NW 10-M. Daugherty Survey, was in the top of the Mississippian at 11,420 ft. It flowed oil on a drill-stem test in the Pennsylvanian from 10,398-468 ft. and there was some speculation on completion from that formation at the time.

Spartan Drilling Co. has filed application to drill a 5,500-ft. rotary wildcat in west central Runnels County, as the Levy Lee, on a 140-acre lease in the southern part of the B. Sandoval Survey 312, 11 miles northwest of Ballinger.

Four miles west of Ballinger and 2 miles west of Strawn production, Kingford Oil Co. 1 R. E. H. Barnett, on a 401-acre lease in the southwest corner of R. Christa Survey, was running 7-in. casing to around 3,069 ft. The well had recovered 250 ft. of 42°-gravity oil, with no water, on a 45-minute drill-stem test early in the week, from 3,063-69 ft., identified as the Canyon sand.

Continental Oil Co. 1 J. M. Barnhill, wildcat 8 miles southwest of Winters in Lot 23, T. M. Fowler Survey 400, had no recovery in swabbing perforations at 3,929-39 ft. in the Palo Pinto lime, and was to acidize the section with 1,000 gal.

Hiawatha Oil & Gas Co. and Plymouth Oil Co. 2 Tad Richards, Block 280, G. Villareal Survey, 5 miles west of Wilmeth, and a long south extension to the Fort Chadbourne field, was drilling below 5,233 ft. in lime, sand and shale.

WEST TEXAS (DISTRICTS 8 AND 7-C) SUCCESSFUL WILDCATS

Crane County: George P. Livermore, Inc. 1 W. E. Connell, NW NW NW 11-B26-PSL, 2 mi. SE C-Bar San Andres field, TD 3,634 ft., elev. 2,738 ft., San Andres 3,585 ft., PB 3,626 ft., flowed 364 bbl. of 33.5°-gravity oil a day, GOR 468 cu. ft., TP 30 psi.

Gaines County: Forest Oil Corp. et al 1-A Parmer CSL, Lab. 12, Lge. 317, Parmer CSL, 15 mi. SE Seminole, 19 mi. E Flannagan field, TD 14,150 ft., PB 12,222 ft., elev. 3,079 ft., Mississippian 11,592 ft., flowed 203 bbl. of 41°-gravity oil a day, ½-in. choke, GOR 1,025 cu. ft., TP 100 psi., perf. 12,100-12,235 ft.

Kent County: General Crude Oil Co. 1-A Percy Jones, NE NE 79-G-W&NW, ½ mi. SW Clairemont, TD 6,752 ft., elev. 2,141 ft., Strawn 6,737 ft., pay 6,742 ft., flowed 384 bbl. of 38.7°-gravity oil a day, natural, ¼-in. choke, GOR 400 cu. ft., TP 600 psi.

Caroline Hunt Trust Est. 1 J. W. Young, 166-G-W&NW, 7½ mi. NW Clairemont, TD 7,232 ft., PB 6,680 ft., elev. 2,088 ft., top reef 6,214 ft. by samples, pay 6,484 ft., flowed 2,184 bbl. 39°-gravity oil a day, ¾-in. choke, GOR 338 cu. ft., TP 225 psi., CP 325 psi., 7-in. casing 6,709 ft., perf. 180 shots 6,484-6,620 ft.

Sterling County: M & M Production Co. 1 D. C. Durham, 19-12-SPRR, 2½ mi. S Sterling City, TD 1,476 ft., elev. 2,441 ft., San Andres 1,407 ft., pay 1,460 ft., pumped 32 bbl. of 33°-gravity oil a day.

Yoakum County: Honolulu Oil Corp. 1 Paul Cobb, SE SW 381-D-J H. Gibson Sur., 2½ mi. NE Ownby San Andres field, TD 11,662 ft. in dolomite, PB 6,220 ft., elev. 3,596 ft., Glorietta pay perf. 536 shots 6,035-6,200 ft., pumped 189 bbl. of 23°-gravity oil, plus 111 bbl. water, San Andres 4,640 ft., Wolfcamp 9,758 ft., Strawn 11,408 ft.

WEST TEXAS (DISTRICTS 8 AND 7-C) WILDCAT FAILURES

Crockett County: Sinclair Oil & Gas Co. 1 F. R. Henderson, SE SE 93-OP-GC&SF, A-2632, 12 mi. S Midway Lane field, dry, TD 8,540 ft., elev. 2,551 ft., Simpson 8,050 ft., Ellenburger 8,080 ft., lower zone 8,460 ft.

Garza County: Comanche Corp. et al 1 Charles A. Bird, 15-8-H&GN, 11 mi. NE Post, dry, TD 3,306 ft., elev. 2,367 ft., saturation and shows of oil in dolomite around 2,700 ft.

Lynn County: Fullerton Oil Co. 1 T. S. Reed, SW NE 39-E-ELRR, 13 mi. NE Brownfield, dry, TD 10,011 ft., elev. 3,218 ft., San Andres 4,305 ft., Sprayberry 6,920-8,140 ft., Wolfcamp 8,145 ft., Dean sand 8,485 ft., sandy lime 9,500 ft.

McCulloch County: O. M. Yoder and A. V. Taylor 1 V. R. Lohn, Sec. 98½, H&TC Sur., 24 mi. N Brady, dry, TD 1,450 ft., elev. 1,670 ft., Ellenburger 1,647 ft., completed as water well.

Runnels County: Joe Parris, Jr., and Earl Calhoun 1 L. S. Evans, W. Brandt Sur. 12, 2 mi.e SE Norton, dry, TD 4,713 ft., elev. 1,840 ft., Saddle Creek 2,350 ft., Flippen 2,450 ft., Palo Pinto 3,836 ft., Marble Falls 4,673 ft., Capps 4,087 ft.

Upton County: Republic Natural Gas Co. and Seaboard Oil Co. 1-A UTL, approximately NW NE 17-15-University Lands, 4 mi. W. Rankin, dry, TD 11,422 ft., elev. 2,545 ft., Yates 2,331 ft., Grayburg 3,840 ft., Tubbs sand 8,022 ft., Devonian 9,482 ft., Fusselman 10,294 ft., Simpson 10,410 ft., Ellenburger by samples 11,070 ft.

SOUTHEAST NEW MEXICO

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April 19, 1950

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Copies of the Prospectus may be obtained from any of the several underwriters, including the undersigned, only in States in which such underwriters are qualified to act as dealers in securities and in which the Prospectus may legally be distributed.

The First Boston Corporation

cap Land Co., Chaves County wildcat in SE SE 6-8s-30e, had total depth at 7,169 ft. A drill-stem test from 7,135-47 ft., open 3 hours and 10 minutes, had gas in 28 minutes and recovered 90 ft. of heavily oil and gas-cut mud, 1,170 ft. of oil and gas-cut salt water, and 300 ft. of salt water. Bottom-hole flowing pressure ranged from 100-400 psi.

In Eddy County, Humble Oil & Refining Co. 1 Federal-Hobbs, SE SE 24-20s-24e, was drilling in dolomite and sand below 11,199 ft. A drill-stem test at 10,843-982 ft., with 1,500 ft. of water blanket, recovered the cushion and 150 ft. of mud in 34 minutes. A second test from 11,073-157 ft., open 1 hour and 28 minutes, recovered the 1,500-ft. water blanket, 300 ft. of mud and 810 ft. of salt water. Top of the Fusselman was 10,272 ft., and the Montoya at 10,842 ft.

In Lea County, Buffalo Oil Co. 20-P Mitchell "B," W½ NE SE 19-17s-32e, was drilling below 5,010 ft. A core from 4,875-92 ft. recovered 16 ft. of hard dolomite, chert and anhydrite, being slightly porous in the top 11 ft., bleeding oil and salt water. Top of the San Andres was 3,670 ft.

SOUTHEAST NEW MEXICO SUCCESSFUL WILDCAT

Chaves County: Honolulu Oil Corp. 1 Texas Co.-State, NW SE 13-11s-27e, 18 mi. SE Roswell, TD 6,933 ft., PB 6,563 ft., elev. 3,763 ft., Devonian 6,485 ft., pay 6,490 ft., pay 6,490 ft., flowed 170 bbl. 39°-gravity oil a day, 11/32-in. choke, CP 85 psi., TP 60 psi.

SOUTHEAST NEW MEXICO WILDCAT FAILURE

Lea County: Ralph Lowe 1 Haralson, (formerly 1 Magnolia-Federal), NW NW 19-26s-38e, 1 mi. E Plains Production Co. 1 Scarborough, dry, TD 3,750 ft., elev. 2,998 ft., anhydrite 1,006 ft., base salt 2,550 ft., Yates 2,710 ft., Queen 3,548 ft.

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SOUTHWEST TEXAS

Humble Opens New Pay Zone in Nicholson Field

CORPUS CHRISTI.—New pay has been opened in Nicholson field, Webb County, at the Humble Oil & Refining Co. 3 W. R. Nicholson. Through perforations at 6,050-55 ft., the well flowed 39 bbl. of 37.7°-gravity oil daily through a ¼-in. choke under tubing pressure of 750 psi. Total depth of the new producer is 8,005 ft. Located in the BS&F Survey 986, it is 4,480 ft. north-northeast of the 1 Nicholson discovery well for the field, which was completed through perforations at 5,574-77 ft. for 19 bbl. of oil daily.

W. B. Osborn has perforated the Seiler sand in the 1 Mrs. Mittie Holshouser and completed as a gas producer. The well is at a depth of 5,320 ft. and has 5½-in casing set around 5,260 ft., and is now waiting on potential. It is located 1 mile southwest of Alice in Jim Wells County.

Six miles south of Sullivan in Guadalupe County, C. O. Hagen tested 4 bbl. of oil per hour on pump through perforations at 2,436-501 ft. in the 1-A Isaac Allen, James M. Bell Survey. The operator has set 5½-in. pipe at 2,518 ft. in the wildcat. It is located approximately 53 ft. southeast of the 1 Allen, junked hole.

Also in Guadalupe County, Bert R. Smith and Hugh Nichols are testing shows in the Buda lime and Austin chalk through open hole from 2,147-313 ft. in the 1 Tom Anderson. The hole is bottomed at 2,313 ft. and operators have set 5½-in. casing at 2,147 ft. Test is located in the Green DeWitt Survey 11, 8 miles east of Seguin.

Killam & Hurd, Inc., have run a drill-stem test in the 1 Marrs McLean, 2,500-ft. wildcat 8 miles southwest of Bruni, Webb County. The well recovered gas and developed 450 psi. pressure. No details are known as to what depth the test was run. The prospective gasser is in Block 18 of the James Subdivision in the Albercas Grant.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) SUCCESSFUL WILDCAT

Webb County: New pay at Nicholson—Humble Oil & Refining Co. 3 W. R. Nicholson, BS&F Sur. 986, top pay 6,050 ft., TD 8,005 ft., perf. 6,050-55 ft., IP: 39 bbl. oil per day, ¼-in. choke, GOR 3,112, TP 750, 37.7° gravity.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) WILDCAT FAILURES

Atascosa County: H. R. Smith, Stanolind Oil & Gas Co. and Forest Oil Corp. 1 A. J. Krause, Block 7, Natascosa Colony Farms Subd., 1 mi. N of Jourdanton field, dry, TD 7,703 ft.

Bastrop County: Six Sullivan 1 Turner, Addison Litton Sur., 1 mi. SE of Bastrop, dry, TD 2,102 ft.

Duval County: Argo Oil Corp. 3 John M. Bennett, Jr. et al, SK&K Sur. 199, A-547, 12 mi. NW of Realitos, dry, TD 3,711 ft.

Ralph E. Fair, Inc. and Woodward & Co. 1 Lundell, Sec. 364, J. Poitevent Sur. 364, 5 mi. NW of Freer, dry, TD 8,500 ft.

Harry Hines and B. H. Hilburn 1 Mrs. Rosa V. Benavides, M. Arispe Grant, 5 mi. NE of Bruni, dry, TD 1,893 ft.

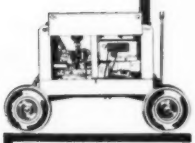
Kirkwood & Co. et al 1 Hagist Ranch, BS&F Sur. 267, 8 mi. NW of Freer, dry, TD 2,190 ft.

Stewart & Ross 1 J. T. Dinn, J. Poitevent Sur. 456, 8 mi. NE of Bruni, dry, TD 2,996 ft.

Guadalupe County: W. R. and J. W. Parrish 1 W. M. Gibbons, J. N. de los Cortinas Sur., A-91, 10 mi. SW of Seguin, dry, TD 2,163 ft.

Jim Hogg County: Humble Oil & Refining Co. B-1 Moody Ranch, El Sordo Grant, Moody Ranch area, 10 mi. SW of Hebbronville, dry, TD 5,505 ft.

Jim Wells County: Rock Hill Oil Co. et al 1 Joe Gwosdz, Block B, W. B. Bode



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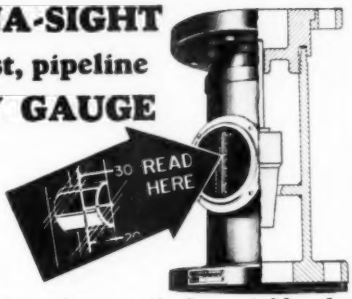

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Subd. of Wade Ranch, 2 mi. SW of Sandia, dry, TD 5,010 ft.

Milam County: Chester H. St. Clair and R. B. Paxson 1 Paul Graves, R. Davidson Sur., 2 mi. S of Sharp, dry, TD 1,575 ft.

Nueces County: Marks, Weisman & Train 1 Joe Hroch, W. J. Robertson Farm Tracts, 3 mi. NE of London Gin field, dry, TD 5,846 ft.

H. H. McFarland 1 Fannie B. Nason, Juan Jose de la Garza Montemayor et al Sur., 5 mi. N of Banquete, dry, TD 6,238 ft.

Starr County: Mitchell & Clopton 1 Green & Manning, Lot 10, Share 38-C, Porcion 80, 4 mi. N of Rio Grande City, dry, TD 4,842 ft.

Patrick H. Downing 1 R. C. Roos, Porcion 90, 8 mi. E of Rio Grande City, dry, TD 4,047 ft.

ROCKY MOUNTAIN

Continental Credited With New Sussex Sand Discovery

DENVER—Following the recovery of oil on tests in the Sussex sand at a wildcat location between the two fields in the Sussex Unit it is apparent that Continental Oil Co. has a new discovery in that area. This will be the fifth pool to produce oil along the Sussex-Meadow Creek Anticline.

The well is Continental's 15 Unit, SE NE SW 15-42n-78w, and Sussex sand was topped at 4,119 ft. On drill-stem test 4,123-4,158 ft., the well made 600 ft. of green oil and 150 ft. of oil and gas-cut mud in 33 minutes. Continental is drilling ahead for the Lakota sand at around 7,200 ft. This well is ¾ mile northwest of the closest producer in East Sussex pool, where production is from the Lakota and First Wall Creek sands with Sussex sand dry in that field.

One and a half miles west of the new discovery Continental produces oil from Lakota sand only, although oil has been recovered on tests in the Sussex sand. Discovery was made in the Sussex area in 1948 and there are now 17 Sussex sand producers, 11 Lakota sand wells, and 1 Wall Creek sand well in the four pools in this area. Fourteen drilling rigs are now running in the area with several wildcat wells projected east, west, and south of the Sussex-Meadow Creek fields.

At 1 Brockelsby, NW SE SE 1-14n-50w, an extension in the Huntsman field, Cheyenne County, Nebraska, Ohio Oil Co. has recovered 3,913 ft. of 38.4°-gravity oil on 30-minute drill-stem test in the First Dakota sand. The test was made between 4,670-4,680 ft. In the Second Dakota two tests indicated approximately 10,000,000 cu. ft. of gas daily between 4,787-4,817 ft. Ohio is now coring below 4,833 ft. at the well. This well is located 1 mile northwest of Ohio's Huntsman discovery well which was completed for 54,000,000 cu. ft. of gas daily from the Third Dakota sand. Ohio now has two gas wells and one shut-in oil well in the Huntsman area. At its Sunol wildcat 2 miles east of the Huntsman discovery at 1 McLernon, NE NE NE 9-14n-49w, Ohio tested water in the First Dakota sand. Casing was cemented at 4,959 ft. after the well was plugged back from Third Dakota which made water. The operator perforated opposite First Dakota between 4,490-4,504 ft. and swabbed 62 bbl. water and 58 bbl. of oil in 8 hours. The zone has been squeezed and the operator will perforate and retest in the top of Dakota. This well was a disappointment in Third Dakota sands as Ohio had hoped to develop an extensive gas area in these fields.

One of the most interesting wildcats now drilling in Wyoming is in the Frontier formation after having found slight shows of gas in that zone. The well is Hamm Brewing Co.-Trigood Oil Co. 1 Unit, SE NW SW 21-54n-100w, in the McCullough Peak area, Park County, Wyoming. The operator is now coring below 12,087 ft. on the wildcat.

Top of Frontier was found at approximately 11,865 ft. and shows of gas and distillate were logged in that section. However, the zone was hard and tight and on drill-stem test 11,871-11,897 ft. the well made only a slight flow of sweet gas.

WILDCAT FAILURE IN COLORADO

Missouri Canyon, Larimer County: Rich Hill Oil Co. 1 Neville, NE NE SW 31-6n-69w; 148 TD; suspended indefinitely.

WILDCAT FAILURE IN MONTANA

Agawam, Teton County: Union Oil Co. et al 1 Fornfeist, C NE NE 19-26n-3w; 1,961 TD; abandoned; Kootenai 1,228, Sunburst 1,590, Morrison 1,623, Swift 1,740, Reardon 1,820, Madison 1,857.

WILDCAT FAILURES IN IDAHO

Indian Cove area, Owyhee County: Helmerich & Payne 1 Parker, SE SE SW 19-6s-8e; 3,808 TD; abandoned; Bastit 2,490.

Helmerich & Payne 1 State, C NW NW 16-6s-7e; 2,660 TD; abandoned; Basalt 2,550.

LA.-ARK.

Lincoln Parish Well Tests Small Amounts of Oil

SHREVEPORT.—Southwest Natural Production Co. 1 M. E. Colvin, 31-20n-2w, Lincoln Parish wildcat, continues testing. Perforations at 8,556-72 ft. were acidized with 500 gal., then drill-stem tested with packer at 8,540 ft. Using ¼-in. chokes and 500 ft. of water cushion, the 1½-hr. test recovered the cushion plus 360 ft. of gas-cut mud. It was reperforated from 8,561-71 ft. with 24 jet shots, acidized with 1,000 gal., and flowed small amounts by heads. Reports did not indicate what it was flowing.

In Bossier Parish, Sinclair Oil & Gas Co. 1 Vera Oden, 33-19n-193w, was drilling in shale and lime below 6,980 ft.

John S. Neilson 1 Chas. G. Simmons, Caldwell Parish wildcat in 31-15n-4e, was drilling below 4,812 ft. in shale. A core from 4,664-84 ft. recovered 18 ft., being 5 ft. of porous sand with salty taste and 13 ft. of hard gray shale.

In Catahoula Parish, Petersen Drilling Co. et al 1 Womach-Cotton, Willow Lake field deep test, was drilling below 7,054 ft. Operators cut 77 side-wall cores in the Wilcox, recovering oil shows between 5,071-75 ft. Top of the Wilcox was 3,756 ft.

Bert Fields 1 Thigpen-Herold, 23-16n-16w, Caddo Parish, had total depth at 9,004 ft., and was preparing to drill-stem test. A drill-stem test of 152 perforations from 8,980-99 ft., with packer at 8,945 ft., produced a slight blow for 1 hour, then died. Recovery, if any, was not reported. It was acidized with 500 gal., swabbed dry, then retreated with 2,000 gal.

NORTH LOUISIANA SUCCESSFUL WILDCAT

Webster Parish: Hunt Oil Co. and Stanolind Oil & Gas Co. 1 Lee Walker, NE SE 2-23n-10w, TD 12,200 ft., PB 5,900 ft., perforated Pettit 5,730-81 ft., IP pumped 77 bbl. oil a day.

NORTH LOUISIANA WILDCAT FAILURES

Caddo Parish: Rogers & Zellner 1 Fred McClure, 35-19n-15w, dry, TD 1,060 ft.

DeSoto Parish: R. E. King 1 Lucy Grant, 8-16n-7e, dry, TD 3,005 ft., Cook Mountain 2804 ft., Sparta 307 ft., Talahatta 1,097 ft., Wilcox 1,172 ft., Midway 1,984 ft., Tuscaloosa 2,479 ft., upper Glen Rose 2,856 ft., Massive anhydrite 2,904 ft.

ARKANSAS WILDCAT FAILURE

Ouachita County: McAlester Fuel Co. 1-A E. F. Graves, CW½ SW SE 22-14s-18w, dry, TD 3,500 ft.

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ILL.-IND.-KY.

Posey County Wildcat Showing for Producer

AURORA GASOLINE CO. and associates appear to have discovered another oil pool for Posey County, Indiana, at their 1 Jackson, NE SW SE 10-6s-13w, where testing of good showings encountered in the Aux Vases is under way. Pay zone was logged at 2,779-85 ft. A drill-stem test taking in an interval from 2,776 to bottom at 2,800 ft., showed gas in 35 minutes and resulted in a recovery of 660 ft. of clean oil and 60 ft. of mud-cut oil with no trace of water. Indicated bottom-hole pressure was 1,000 psi. Present swabbing tests are being made with 5½-in. casing at 2,770 ft.

The area is about 6 miles north of Mount Vernon. Nearest oil production is in the Farmersville pool, about 2 miles to the southwest. There is some small gas production in the Oliver area about the same distance to the east.

Illinois Mid-Continent Co. 1 C. Leighty, NE NW SE 20-3n-11w, in the recently developed extension area on the east side of production at the southern end of the Lawrence pool, Lawrence County, Illinois, is showing for an exceptionally good well for the area. In a drill-stem test of McClosky lime at 1,821-28 ft., the well showed gas within 2 minutes and started flowing clean oil within 8 minutes. Flow was estimated at the rate of 100 bbl. per hour. Casing has been run to the top of the above interval for completion. Total depth is 1,829 ft. The area is about 3 miles southeast of Lawrenceville.

A substantial increase in production has resulted from acidizing at Joe Reznik and Collis P. Chandler's oil discovery well, 1 Trigg, SW NE NE 21-P-21, 2 miles south of Smith Mills, Henderson County, western Kentucky. With a 2,000-gal. treatment, the well swabbed 14 bbl. of clean oil per hour. Prior to acidizing, it swabbed at the rate of 120 bbl. per day. Pay zone is the McClosky lime at 2,586-88 ft. Testing continues.

Further confirmation of the Diamond Island pool, Henderson County, western Kentucky, has been given with the completion by Nash Redwine of his 3 Bower, 6-Q-22. The well, the third producer for the pool, pumped 146 bbl. of oil daily at completion in the pool's Rosiclare pay zone found at 2,579-88 ft. A fourth prospective well, George S. Engle and associates 2 Bower, 15-Q-21, has oil string run preparatory to testing. It has the Rosiclare at 2,576-86 ft. A drill-stem test of this interval got 380 ft. of gas, 50 ft. of oil-cut mud and 30 ft. of mud-cut oil. The pool, located on a small island in the Ohio River, was opened last October.

ILLINOIS SUCCESSFUL WILDCAT

Clay County: The Texas Co. 1 Harrell, NE NW NE 34-4n-5e, IP 284 bbl., Benoist 2,582-93 ft., TD 2,598 ft. (Extension Oskaloosa pool.)

ILLINOIS WILDCAT FAILURES

Clinton County: C. J. Goldschmidt 1 McQuade, SE NE NW 15-3n-3w, dry, TD 1,203 ft.

F. E. Turner 1 Rohlferg, SE SW SE 16-1n-2w, dry, TD 2,752 ft.

Edgar County: W. W. Drake 1 Krabel, SE SE NE 36-13n-13w, dry, TD 1,060 ft.

Franklin County: W. I. Lewis 1 Stewart, NW SW SE 8-5s-4e, dry, TD 3,183 ft.

Hamilton County: Robinson & Puckett, NW NE NW 25-5s-7e, dry, TD 3,598 ft.

Lawrence County: Big Four Oil & Gas Co. and Hayes Drilling Co. 1 Bowers, NW NW SE 23-3n-13w, dry, TD 2,158 ft.

Marion County: Ryan Oil Co. 1 Dykes, SW SE SE 15-1n-1e, dry, TD 2,305 ft.

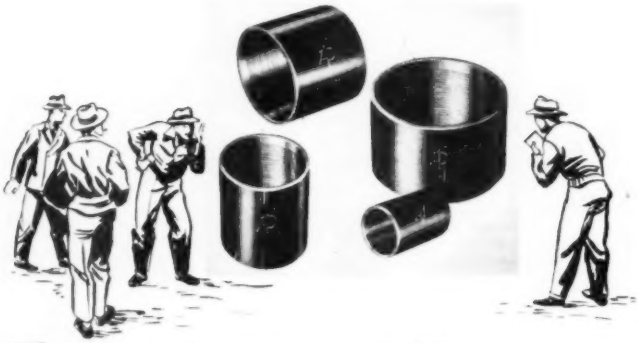
Richland County: Don Baines 1 Whitaker, NE SE SE 3-2n-10e, dry, TD 3,326 ft.

White County: J. M. Miller 1 Boierjack, NE NE SW 18-6s-8e, dry, TD 3,380 ft.

INDIANA WILDCAT FAILURES

Daviess County: N. W. Strange 1 Ryan SW SW SW 32-4n-6w, dry, TD 1,303 ft.

(Continued on page 254)



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Gas Completion Links Perry County Fields

COLUMBUS.—Mid East Oil 2 L. J. Curry, Section 33, Hopewell Township, Perry County, connects Baker pool with the older gas pool in the southwest part of the township. The Clinton sand came in at 2,937-71 ft., and gaged 1,100,000 cu. ft. of gas, natural, with a rock pressure of 950 psi.

Shuff and Bucy found the Berea sand dry in the 1 Orville Ross, Lot 23, Clay Township, Knox County, and deepened it to the Clinton. The sand, logged at 2,832-60 ft., made 660,000 cu. ft., natural, and is the first gas found in this new pool west of Bladensburg.

E. A. Firebaugh's second test in Jefferson Township, Richland County, picked up a stray sand at the same horizon as the first well. The 1 W. Garber, Section 13, gaged 1,180,000 cu. ft. of gas at 775 ft., which was cased off. Drilling is being continued down to the Clinton.

The Brendel Oil & Gas Co. completed four wells in Terryton pool, Jackson Township, Muskingum County. The 1 Herman Baughman, Section 7, made 49 bbl. of oil in 24 hours after a 200-quart shot; the 2 J. Ashcraft, Section 7, made 100 bbl. after a 170-quart shot; the 1 Burnside, Section 15, was plugged after a show of gas; the 1 M. J. Fairall, Section 14, had a show of oil and was plugged.

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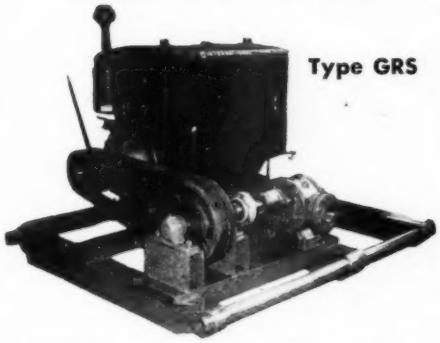

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KANSAS

Hodgeman County Wildcat Finds Good Oil Showings

PROMISING oil and gas showings have been found by a rank wildcat test located in the middle of that wide open region between the Central Kansas Uplift and the Hugoton gas field in the central western part of the state.

The wildcat is Shell Oil Co. 1 Springer, SE SW SW 24-22-24, 2 miles north of Jetmore in central Hodgeman County. Best showings were in the Sooy conglomerate (basal Pennsylvanian), topped at 4,569 ft. (—2,186 ft.). In a 45-minute drill-stem test taking in an interval at 4,559-84 ft., recovery was 1,100 ft. of gas, 2,250 ft. of 39.5° oil and 30 ft. of oil-cut mud. Indicated bottom-hole pressure was 1,400 psi.

Additional, but not so strong, showings were found in the Mississippian, topped at 4,594 ft. (—2,211 ft.). Good porosity existed in the upper part. A 30-minute drill-stem test at 4,599-4,649 ft. yielded 60 ft. of free oil and 160 ft. of heavily oil-cut mud. Operators are drilling ahead.

If this makes a well, it will be the first production for Hodgeman County. Nearest production now is in the Manteno pool, about 25 miles to the northwest in southern Ness County. Other pools in the general region are few, small and widely scattered. The Hugoton gas area is about 50 miles to the west.

In Graham County, at the northwestern extremity of the Central Kansas Uplift trend of fields, Aurora Gasoline Co. has another prospective discovery well at its 1 Walker, NE NE NE 16-9-22. A 15-minute drill-stem test at 3,948-61 ft. in Arbuckle lime, topped at 3,946 ft. (—1,619 ft.), yielded 450 ft. of free oil and 30 ft. of oil-cut mud. Casing has been run through the pay to 3,960 ft. and will be perforated in the above pay for completion.

KANSAS SUCCESSFUL WILDCATS

Barton County: Yellow Cab Co. 1 Boyle, SE SW SE 17-17s-14w, 48 bbl. of oil per day from Arbuckle at 3,401-08 ft., TD.

Stafford County: Westgate-Greenland et al 1 Doran, SE NE NE 14-21s-13w, 120 bbl. of oil per day from Arbuckle at 3,546-53 ft., TD.

KANSAS WILDCAT FAILURES

Barber County: Champlin et al 1 Stump-Smith, SW SW SE 12-32s-15w, dry, TD 5,150 ft.

Barton County: Transit Corp. 1 Putnam, NW NW SW 7-17s-13w, dry, TD 3,571 ft.

Elreco 2 Rexroat, SE SE SW 11-17s-13w, dry, TD 3,374 ft.

The Texas Co. 1 Lathrop, SW SW NE 29-19s-11w, dry, TD 3,440 ft.

Butler County: W. L. Hartman 1 Lygrisse, SW NE 24-26s-3e, dry, TD 3,079 ft.

Chase County: Stanolind et al 1 Leith, NE SW NE 22-17s-9e, dry, TD 3,153 ft.

Ellis County: Stormfeltz 1 Never, NW NW SW 6-11s-16w, dry, TD 3,475 ft.

McPherson County: Bennett & Roberts et al 1 Oliver, SW SW SW 29-19s-3w, dry, TD 3,858 ft.

Rice County: Brunson Drilling Co. 1 Johnston, SW NW SE 22-19s-8w, dry, TD 3,300 ft.

Rooks County: Westgate-Greenland 1 Johnson, SE SW SW 24-6s-20w, dry, TD 3,908 ft.

Stafford County: Keyes 1 Copeland, NE NE NE 2-21s-11w, dry, TD 3,411 ft.

Gore and Veeder 1 Peterson, SE SE NE 6-21-11w, dry, TD 3,475 ft.

Lindas Oil et al 1 Vanhoozer, SE SE SW 36-23s-14w, dry, TD 4,162 ft.

Aylward Drilling Co. 1 Newell, NW NW NE 6-25s-11w, dry, TD 4,143 ft.

Sumner County: Herndon Drilling Co. et al 1 Wright, NW NE SW 16-34s-1e, dry, TD 4,140 ft.

Wabaunsee County: Appleman and Adkins Drilling Co. 1 McLaughlin, SE SE SE 26-10s-11e, dry, TD 3,243 ft.

Woodson County: Edwards et al 1 Holley, C SW SW 12-25s-14e, dry, TD 1,604 ft.

Number of Well Completions and Footage Reach New Peak for Year

by Polly DeArmond

THE number of new wells and footage drilled during March became the record for such activities so far this year. In addition, the 3,417 completions and 12,952,782 ft. not only represented gains over the same month of last year, but also brought the first-quarter cumulative figures well ahead of the first 3 months of 1949.

March vs. February 1950

In the comparison of March with the preceding month, completions rose 502 wells, or 17.2 per cent, and footage was up almost 2 million feet, or 17.5 per cent. Gains in both categories were reported for all but two areas (Rocky Mountain region and Pacific Coast). The Texas-New Mexico district paced the operations with a 25.6 per cent increase in completions and 23.5 per cent increase in footage drilled. The Mid-Continent section, including, Oklahoma, Kansas, and Nebraska, was up 14.9 per cent in wells and 13.5 per cent in footage. Completions were carried to greater depths in the Southern states (Arkansas, Louisiana, Mississippi, Alabama, Georgia, and Florida) which reported an increase of 21.3 per cent in footage for a 13.9 per cent gain in wells. The North Central division, made up of Ohio, Kentucky, Indiana, Illinois, and Michigan, also drilled deeper wells during March: up 17.5 per cent in footage and 11.3 per cent in completions. The Eastern area of New York, Pennsylvania, and West Virginia was up 8 per cent in wells and 9.1 per cent in footage.

March vs. March

Total increases over March 1949 were 9.4 per cent in wells and 9.6 per cent in footage. The Mid-Continent section led in this comparison with gains of 41.9 per cent in completions and 37.6 per cent in footage. Texas and New Mexico rose 18.2 per cent in wells and 17.6 per cent in footage, while the Southern states were up 10 per cent in wells and 12.5 per cent in footage. The Eastern, North Central, Rocky Mountain, and Pacific districts all reported declines in both categories, with the largest losses occurring in the western areas.

Cumulative Comparisons

The same areas as in the March-vs.-March analysis reflected the gains and losses in the cumulative comparison. In the first 3 months of this year, the Mid-Continent section completed 37.5 per cent more wells with 31.7 per cent more footage than during the same period of 1949. Texas-New Mexico rose 20.5 per cent in wells and 19.6 per cent in footage. The Southern states were up 14.8 per cent in completions and 14.9 per cent in footage. The greatest decreases were noted in the Eastern and Pacific divisions, while the North Central and Rocky Mountain regions recorded smaller declines in both categories.

SUMMARY OF COMPLETIONS, MARCH 1950

	Total comp.	Oil	Gas	Dry	Under 2,500 ft.	2,500-5,000 ft.	5,000-7,500 ft.	7,500-10,000 ft.	10,000-12,500 ft.	Over 12,500 ft.	Total footage	Rigs and drilling
New York	33	17	0	16	33	0	0	0	0	0	47,556	§59
Pennsylvania	120	57	22	41	100	20	0	0	0	0	211,294	226
West Virginia	63	21	26	16	45	13	5	0	0	0	136,690	*152
Ohio	71	24	17	30	35	35	1	0	0	0	165,023	110
Indiana	99	37	3	59	84	15	0	0	0	0	173,743	148
Kentucky	70	29	17	24	53	16	1	0	0	0	132,646	70
Illinois	143	55	1	87	75	68	0	0	0	0	312,752	215
Michigan	51	25	0	26	24	27	0	0	0	0	135,164	140
Kansas	292	169	9	114	40	251	1	0	0	0	927,299	404
Neb., Mo., Iowa	5	2	1	2	0	5	0	0	0	0	19,742	9
Oklahoma	451	280	24	147	150	212	73	10	5	1	1,566,608	728
Texas	1,532	966	73	493	444	517	425	122	21	3	6,563,302	1,519
North	322	175	2	145	190	94	38	0	0	0	866,932	200
West Central	173	74	6	93	75	84	14	0	0	0	523,559	148
West	467	392	1	74	79	105	227	45	8	3	2,501,692	621
Panhandle	90	55	26	9	1	88	0	1	0	0	287,712	99
East	98	53	7	38	25	44	20	8	1	0	387,276	83
Gulf Coast	195	112	20	63	21	40	81	44	9	0	1,156,676	213
Southwest	187	105	11	71	53	62	45	24	3	0	840,055	155
Louisiana	200	133	14	53	52	25	40	41	38	4	1,255,972	245
Northern	91	56	13	22	51	15	16	7	2	0	318,854	77
Southern	109	77	1	31	1	10	24	34	36	4	937,118	168
Arkansas	28	17	0	11	8	19	1	0	0	0	85,782	31
Mississippi	28	13	1	14	0	1	16	10	1	0	197,941	33
Ala., Ga., Fla.	5	0	0	5	2	1	1	0	1	0	23,163	5
Idaho	1	0	0	1	0	1	0	0	0	0	3,808	3
Montana	8	6	0	2	7	1	0	0	0	0	14,469	41
Wyoming	30	22	2	6	2	13	13	2	0	0	141,809	98
Colorado	0	0	0	0	0	0	0	0	0	0	0	21
Utah	1	1	0	0	0	1	0	0	0	0	4,330	11
Dakotas	1	0	0	1	0	0	1	0	0	0	5,759	2
New Mexico	56	36	10	10	13	27	7	6	2	1	251,200	‖103
California	128	99	2	27	31	57	24	12	3	1	570,042	185
Washington	1	0	0	1	0	0	1	0	0	0	6,688	2
Total March 1950	3,417	†2,009	222	*1,186	1,198	1,325	610	203	71	10	12,952,782	‡4,560
Total February 1950	2,915	1,671	185	1,059	1,014	1,195	488	132	72	14	11,027,811	4,192
Total March 1949	3,123	1,816	212	1,095	1,099	1,293	437	201	86	7	11,721,795	4,767
Cumulative 1950	9,434	5,486	631	3,317	3,300	3,810	1,545	517	228	34	35,617,552	
Cumulative 1949	8,789	5,034	588	3,167	3,176	3,602	1,201	537	228	25	32,073,911	

*Incl. 83 service wells: N. Y. 16, Pa. 37, Ohio 2, Kans. 4, Okla. 11, N. Tex. 9, W. Cent. Tex. 2, N. La. 2. †Incl. 41 distillate wells: Okla. 5, E. Tex. 1, Tex. Gulf 6, S.W. Tex. 7, N. La. 7, S. La. 10, Miss. 5. ‡Incl. all wells rigged up and/or drilling at end of month. §Incl. 2 Md. ¶Incl. 2 Va. ‖Incl. 5 Ariz.

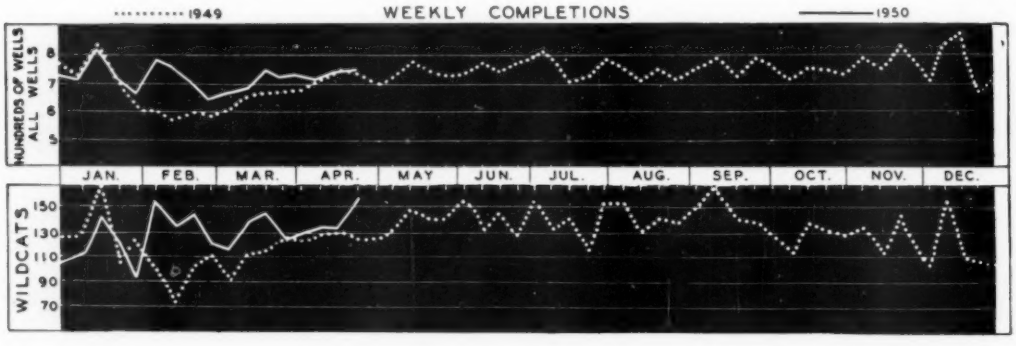
CURRENT STATISTICS

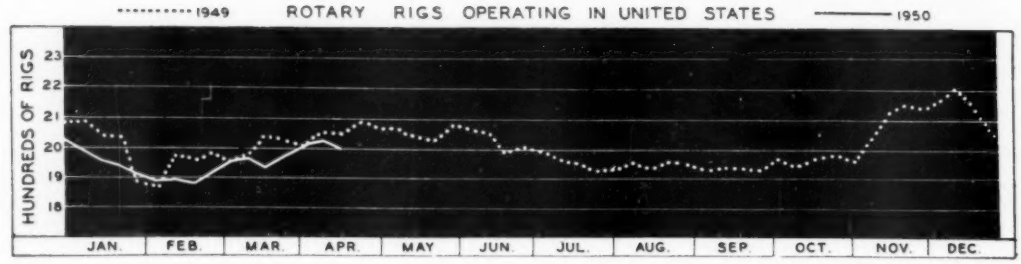
EXPLORATION

WEEKLY WELL COMPLETIONS . . . . . WEEK ENDED APRIL 22, 1950

	Total of all wells					Apr. 22		Wildcat completions and discoveries					Cumulative total, 1950				
	Comp.	Oil	Gas	Dry	Footage	1950	1949	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	7	4	0	*3	9,242	147	421	0	0	0	0	0	0	0	0	0	0
Pennsylvania	17	7	3	†7	29,362	332	686	0	0	0	0	0	0	0	0	0	0
West Virginia	14	5	5	4	36,074	183	160	0	0	0	1	1	0	0	4	7	11
Ohio	22	9	5	18	46,766	279	349	0	0	0	0	0	1	0	1	5	7
Indiana	22	11	1	10	41,131	320	329	0	0	0	4	4	9	0	1	52	62
Kentucky	14	4	0	§10	18,825	244	256	0	0	0	3	3	5	0	1	19	25
Illinois	36	19	0	17	79,292	645	618	1	0	0	9	10	11	0	0	159	170
Michigan	12	4	0	8	32,085	193	267	2	0	0	6	8	10	0	2	81	93
Kansas	77	41	4	†32	256,401	1,064	869	2	0	0	17	19	23	0	2	155	180
Nebraska	1	0	0	1	4,554	21	11	0	0	0	0	0	0	0	1	11	12
Oklahoma	104	62	2	40	391,198	1,518	1,179	3	0	1	14	18	44	3	7	196	250
Texas	298	184	5	109	1,375,017	4,625	3,929	13	0	0	60	73	146	11	39	747	943
North Central (Dist. 7-B & 9)	94	43	1	§50	286,898	1,448	1,259	3	0	0	26	29	49	2	11	272	334
West (Dist. 7-C & 8)	92	83	0	§9	536,538	1,348	863	6	0	0	6	12	38	1	0	154	193
Panhandle (Dist. 10)	12	7	2	3	35,974	308	307	0	0	0	0	0	1	0	2	8	11
Eastern (Dist. 5, 6, & 6-P)	17	11	0	6	57,374	311	302	0	0	0	3	3	3	1	1	74	79
Gulf Coast (Dist. 2 & 3)	45	26	1	18	284,208	627	550	3	0	0	10	13	28	3	13	94	138
Southwest (Dist. 1 & 4)	38	14	1	23	174,025	583	648	1	0	0	15	16	27	4	12	145	188
Louisiana	47	27	4	16	263,818	679	613	1	0	0	5	6	21	5	4	55	85
Northern	28	15	2	11	101,090	355	312	1	0	0	2	3	4	0	1	26	31
Southern	19	12	2	5	162,728	324	301	0	0	0	3	3	17	5	3	29	54
Arkansas	6	4	0	2	16,931	102	87	0	0	0	1	1	1	0	0	26	27
Mississippi	5	2	0	3	34,073	97	110	0	0	0	3	3	4	1	0	35	40
Southeastern States	0	0	0	0	0	19	16	0	0	0	0	0	0	0	1	12	13
Montana	17	10	3	4	34,625	46	60	0	0	0	1	1	0	0	0	9	9
Wyoming	7	6	0	1	30,810	163	162	0	0	0	0	0	4	0	0	22	26
Colorado-Utah	1	0	0	1	148	18	29	0	0	0	1	1	0	0	0	15	15
New Mexico	12	9	1	2	61,261	197	169	1	0	0	1	2	7	0	0	18	25
California	28	22	0	6	108,680	520	807	0	0	0	5	5	9	0	2	95	106
Miscellaneous	2	0	0	2	5,040	5	13	0	0	0	2	2	0	0	0	5	5
Total United States	749	430	33	286	2,875,333	11,417	11,140	23	0	1	133	157	295	20	65	1,724	2,104
Total previous week	742	462	38	242	2,845,709	.....	.....	20	1	3	109	133	272	20	64	1,591	1,947
Total April 23, 1949	788	441	57	290	2,578,745			16	1	3	104	124	269	24	52	1,553	1,898

Service wells included: *3, †7, ‡1, §2, ¶3. ‖Revised.





DAILY AVERAGE PRODUCTION FOR WEEK

	April 22 crude oil	B. of M. April demand	April 15 crude oil
Alabama	1,450	1,000	1,450
Arkansas	80,050	83,000	79,600
California	858,000	842,000	857,200
Colorado	58,800	66,000	57,800
Eastern	60,425	60,900	60,700
Florida	1,200	900	1,040
Illinois	175,500	182,000	178,200
Indiana	27,800	27,000	26,500
Kansas	284,050	280,000	261,950
Kentucky	25,700	25,000	25,200
Louisiana	513,200	548,000	513,200
North Louisiana	118,200		118,200
South Louisiana	395,000		395,000
Michigan	44,600	45,000	43,600
Mississippi	97,500	99,000	94,550
Montana	23,900	25,000	22,900
Nebraska	1,500	1,100	1,450
New Mexico	125,800	132,000	125,800
Oklahoma	435,700	415,000	433,100
Texas	1,982,850	2,060,000	1,982,850
Dist. 1 (Southwest)	26,475		26,475
Dist. 2 (Southwest)	118,900		118,900
Dist. 4 (Southwest)	187,700		187,700
Dist. 3 (Gulf Coast)	348,300		348,300
Dist. 5 (Eastern)	30,550		30,550
Dist. 6 (Eastern)	80,250		80,250
East Texas field	258,000		258,000
Dist. 7-C (West)	47,875		47,875
Dist. 8 (West)	601,850		601,850
Dist. 7-B (W. Central)	63,100		63,100
Dist. 9 (N. Central)	130,550		130,550
Dist. 10 (Panhandle)	89,300		89,300
Utah	3,000	1,100	3,000
Wyoming	159,100	136,000	152,100
Total United States	*4,960,125	5,030,000	4,922,190
Change from previous week, up	37,935		
Canada	63,740		65,690

Total U. S. production January 1-April 22 †554,761,935 bbl.
Same period last year (crude plus cond.) 594,662,820 bbl.

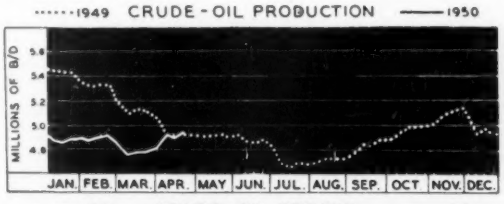
*Not incl. 100,845 bbl. condensate. †Incl. 10,500,560 bbl. condensate.

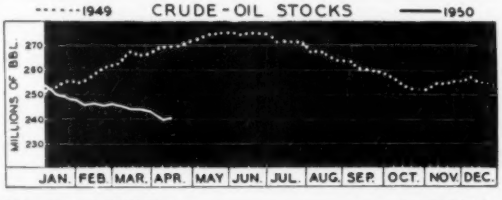
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

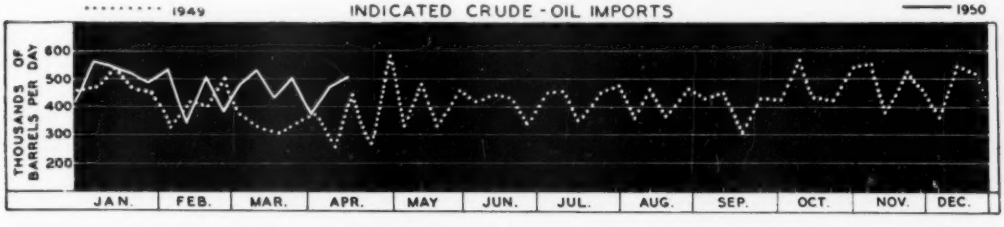
(Thousands of barrels)

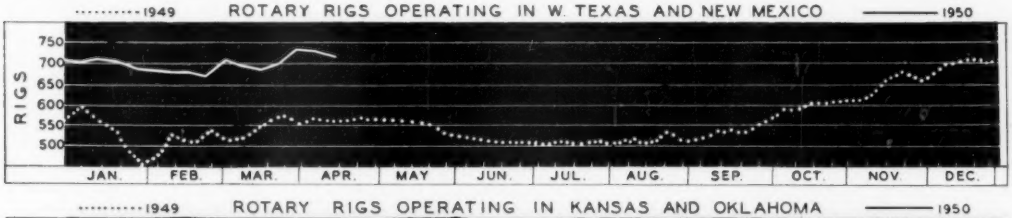
	Apr. 15, 1950	Apr. 8, 1950	Apr. 16, 1949
Pennsylvania Grade	2,742	2,817	3,052
Other Appalachian	1,512	1,517	1,812
Illinois, Indiana, Michigan	9,860	9,696	14,606
Arkansas	3,034	3,145	3,198
Louisiana	14,816	15,230	13,579
North	3,362	3,552	3,553
Gulf	11,454	11,678	10,026
Mississippi	2,472	2,347	2,952
New Mexico	6,549	6,642	7,087
Oklahoma and Kansas	35,283	35,058	38,140
Texas	106,729	105,547	130,137
East Texas	14,223	14,528	17,764
West Texas	39,251	37,374	53,520
Texas Gulf	27,467	28,144	30,099
Other Texas	25,788	25,501	28,754
Rocky Mountain	13,442	13,435	13,141
California	38,174	37,838	34,498
Foreign	6,711	6,151	7,749
Total	241,324	239,463	269,951

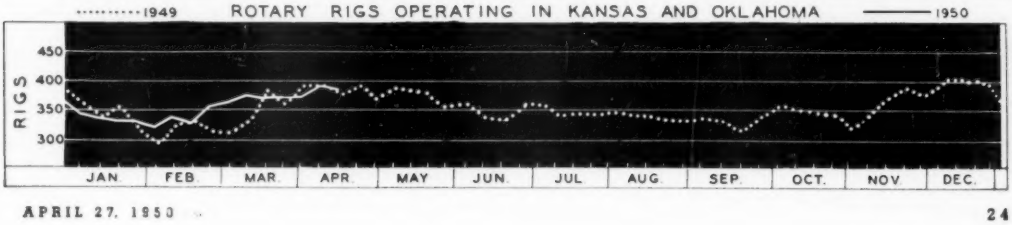
*Bureau of Mines.









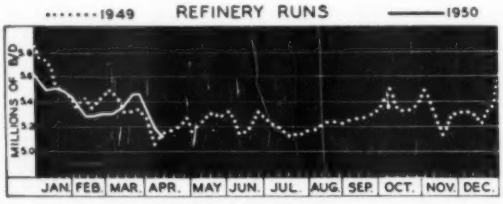


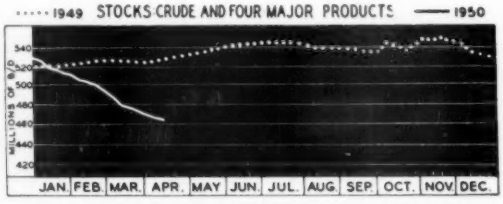
A.P.I. REFINERY REPORT, APRIL 15

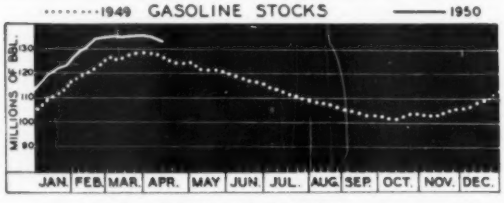
(Thousands of barrels)

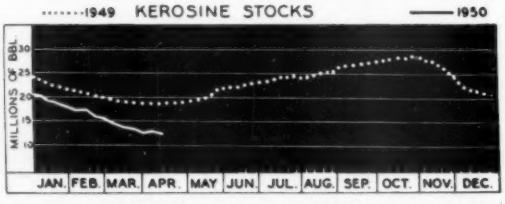
District—	Daily avg. crude runs	Daily average production				Stocks at refineries, bulk terminals, in transit and in pipe lines				Bureau of Mines, April 1949				
		Gasoline*	Kerosine	Distillate	Residual	Gasoline†	Kerosine	Distillate	Residual	Daily avg. crude runs	Daily average production: Gasoline*	Kerosine	Distillate	Residual
East Coast	862	354.7	37.3	168.1	206.8	26,323	4,801	10,084	8,589	736	308.3	31.3	137.5	184.5
Appalachian:														
District 1	91	35.1	4.9	13.9	12.0	2,611	240	365	219	86	39.3	4.8	10.5	8.8
District 2	72	31.3	5.1	8.3	17.4	1,147	76	124	168	67	33.9	3.6	5.8	16.2
Ind., Ill., Ky.	918	440.6	49.6	158.4	160.0	28,536	1,941	4,567	2,287	857	456.5	49.3	125.0	127.0
Okla., Kans., Mo.	439	245.3	20.3	83.7	58.0	14,499	441	2,373	713	394	214.2	22.5	78.3	64.2
Inland Texas	170	170.1	10.6	27.1	43.3	3,728	236	744	621	213	143.5	13.5	18.6	47.5
Texas Gulf Coast	1,002	470.7	87.3	217.6	202.3	20,773	1,878	5,958	3,213	1,235	616.6	75.1	216.1	220.3
La. Gulf Coast	480	236.4	56.4	99.0	47.6	7,412	1,699	2,467	1,878	430	221.7	46.9	93.2	54.9
N. La. and Ark.	68	25.6	7.0	8.9	15.4	3,112	211	422	168	73	27.2	6.4	11.8	14.7
Rocky Mountain:														
New Mexico	13	7.6	.4	2.0	2.9	85	25	77	33	12	6.7	.4	1.6	3.1
Other Rocky Mtn.	156	68.6	2.7	32.6	32.3	5,272	305	1,291	443	143	60.7	5.0	27.0	35.9
California	822	353.9	10.4	147.1	279.3	19,960	833	9,027	21,549	895	365.8	13.4	120.2	370.1
April 15, 1950	5,116	2,402.9	292.0	966.7	1,077.3	133,458	12,686	37,499	39,881	5,141	2,494.4	272.2	845.6	1,147.2
April 8, 1950	5,170	2,541.7	308.0	949.7	1,111.9	135,116	12,784	38,288	40,494					
April 16, 1949	5,143	2,417.0	295.0	854.7	1,183.1	125,922	18,187	49,169	59,440					

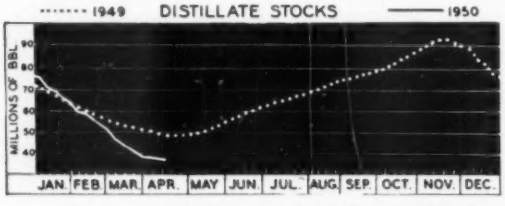
*At refineries including natural gasoline. †Finished and unfinished.

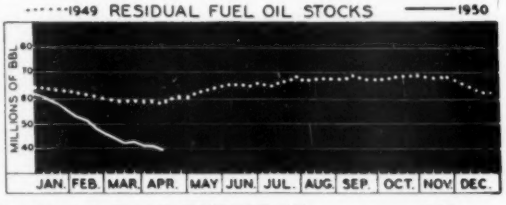


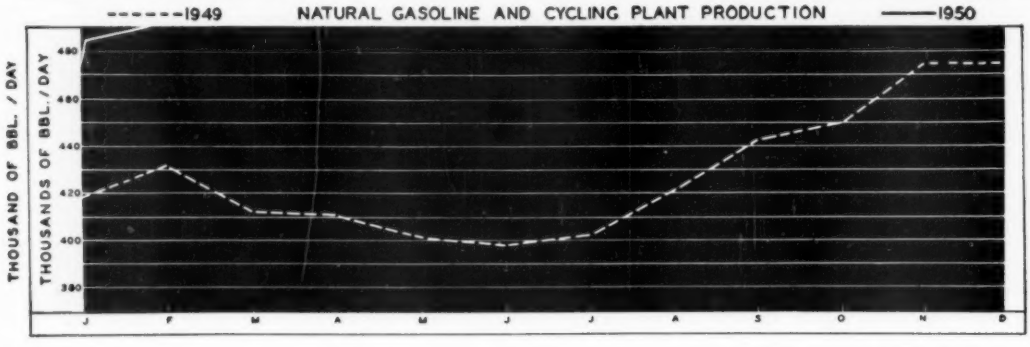












CRUDE PRICES
GRAVITY SCHEDULE

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$1.53			
19-19.9	1.63			
20-20.9	1.73	$2.25		$2.12
21-21.9	1.82	2.27		2.14
22-22.9	1.92	2.29		2.16
23-23.9	2.02	2.31		2.18
24-24.9	2.12	2.33	$2.56	2.20
25-25.9	2.22	2.35	2.58	2.22
26-26.9	2.31	2.37	2.60	2.24
27-27.9	2.37	2.39	2.62	2.26
28-28.9	2.42	2.41	2.64	2.28
29-29.9	2.48	2.43	2.66	2.30
30-30.9	2.54	2.45	2.68	2.32
31-31.9	2.59	2.47	2.70	2.34
32-32.9	2.64	2.49	2.72	2.36
33-33.9		2.51	2.74	2.38
34-34.9		2.53	2.76	2.40
35-35.9		2.55	2.78	2.42
36-36.9		2.57	2.80	2.44
37-37.9		2.59	2.82	2.46
38-38.9		2.61	2.84	2.48
39-39.9		2.63	2.86	2.50
40 and above		2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point.

†Includes Lea County, New Mexico. Last general price change represented a 50-cent increase becoming effective December 6, 1947. Above changes do not include recent reductions of a few buyers applying principally to low-gravity grades.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

East Texas†	$2.65
Kettleman Hills, California*	2.77
Beauregard Parish	2.60
Illinois Basin	2.77
Pecos County, Texas (Yates)	2.35
Bradford, Pennsylvania	3.51
Eastern Ill. and Western Ind.†	2.77
Tomball, Texas Gulf Coast	2.83

*37°-37.9°, †35° and above.

PETROLEUM marketing for the week was highlighted by a general firming in gasoline prices. Socony-Vacuum Oil Co., Inc., announced an increase in gasoline tank-wagon prices at various points in New York and New England effective April 24. Increases averaged a little better than half a cent a gallon. This advance reflected higher Gulf Coast prices and stronger barge prices in New York Harbor.

Mid-Continent gasoline prices moved up under the influence of increased demand, both local and for northern shipment. Recent improvement in Group 3 motor-fuel prices followed an inactive period of several weeks with few offers either to buy or sell gasoline on the spot market.

Increased movement of motor fuel resulted in some improvement in the natural-gasoline market. Group 3 price for 26-70 natural increased 0.125 cent per gallon on April 24 to 4.375 cents. This is still 1.5 cents below the January level and 4.125 cents lower than the peak 1948 price that held until the end of January 1949.

Better gasoline prices are the result of normal seasonal increases in demand at a time when refinery output is restricted by refinery strikes. Refinery runs dropped 300,000 bbl. daily for the week ended April 8 and another 54,000 bbl. daily for the week of April 15. Gasoline stocks were reduced 1,658,000 bbl. in the week ended April 15, the first important decrease of the season.

Low heating-oil inventories brought about by high demands near the end of the normal season have tended to prevent reductions in kerosine and distillate prices. Minor adjustments may be made as sellers compete in local markets, but with the better stock position, most suppliers feel that distress selling will be much less prevalent this summer.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of April 24, 1950. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline, 80-82 octane	9⅝-9⅞	10.6	9¾-10
Premium gasoline, 86-88 octane	10⅜-10¾	11.6	10¼-10¾
42-44 w.w. kerosine	8½-8⅝	8.8	7¾-8¼
No. 2 straw fuel oil	7⅝-7¾	7.6	6⅝-7
No. 6 residual	$1.55-1.65	$2.05	$1.65-1.75

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	4⅜	3⅞	4⅛
Grade 18-55	5.25	4.75	5.0

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	10.5
750 vis., No. 3-4 neutral	12.75
2,000 No. 5-6 neutral	14-14.5

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	17
200 vis., No. 3 neutral, 0-10 pp.	11.5-12.5

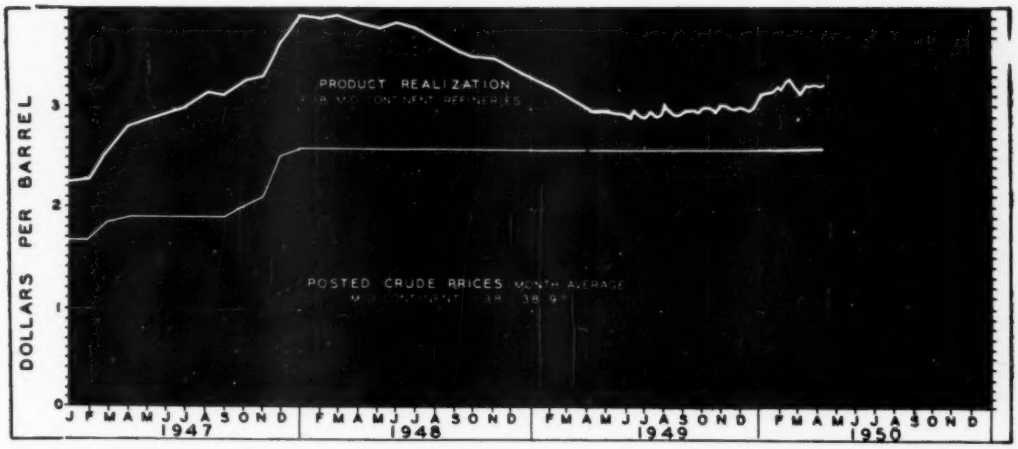
Western Pennsylvania

145-155 vis., 10 p.t. bright stock	19-20.5
180 vis., 0 p.t. neutral	20-21.5

WAX

Mid-Continent

132-134 A.M.P.	4.50


DOLLARS PER BARREL
PRODUCT REALIZATION
POSTED CRUDE PRICES MONTH AVERAGE
0
1
2
3
J F M A M J J A S O N D
1947
J F M A M J J A S O N D
1948
J F M A M J J A S O N D
1949
J F M A M J J A S O N D
1950

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate, and fuel oil

EQUIPMENT MEN . . . in the News

McNamar, McKelvey, Crowley Buy Vulcan Tank

C. A. McNAMAR

Vulcan Steel Tank Corp., Tulsa, has recently been purchased by Charles A. McNamar, Lawrence N. McKelvey, and A. W. (Tony) Crowley, all well known in the steel and oil industry. Vulcan will continue to design and build refinery, gasoline, and chemical-plant vessels in all sizes and weights, but in addition, it is expanding its facilities to serve the production, pipe line, chemical, and marketing fields of the industry.

L. N. McKELVEY

A. W. CROWLEY

McNamar, the new president, has been in the steel business all his life. After attending Notre Dame University, he joined his father in the manufacture of the McNamar drilling boiler, at Bridegport, Ill. In 1932 he moved to Tulsa, where he and his father founded the present McNamar Boiler & Tank Co. However, he disposed of all his interests in that company in 1945.

McNamar is also associated with the Allied Steel Products Corp. of Tulsa. In 1938 he established the plant at Salem, Ill., which is now known as McNamar & Crowley. Under the new Vulcan organization, McNamar will direct sales and developments of the new products.

McKelvey, now the new executive vice president and general manager of Vulcan, started his career working for Brier Hill Steel Co., which is now Youngstown Sheet & Tube Co. He came to Tulsa in 1917, started to work for Pioneer Tank & Boiler Co., where he remained until the early part of 1927 at which time he started in with the newly incorporated Vulcan Steel Tank Corp.

Crowley, after graduating from Notre Dame, moved to Tulsa where he went with Republic Supply Co. Later he joined Bethlehem Supply Co. where he remained until moving to Salem in 1938, after becoming associated with McNamar. Crowley is now president of McNamar & Crowley, Inc., at Salem. As a new vice president of Vulcan he will direct the company's expanding sales organization in the Illinois basin.

H. H. Smith Named Ad Manager for H. C. Smith

H. H. SMITH

H. C. Smith president of H. C. Smith Oil Tool Co., has announced the appointment of Harold H. Smith as advertising manager. Harold Smith has been active in the company as a sales representative for the past 5 years. For the last year, he has been assistant to the general sales manager.

G. E. to Furnish Radio For Transcontinental Line

General Electric Co. has announced that it will build equipment for the world's longest microwave radio-communications system. The system has been purchased by Transcontinental Gas Pipe Line Corp. for the operation and maintenance of its 1,840-mile line now under construction between Mercedes, Tex., and New York City.

Dr. W. R. G. Baker, G. E. vice president at Electronics Park, N. Y., where the equipment will be built, said the radio project will cost almost a million dollars and is the biggest of its kind in the world.

Delivery of mobile radio equipment will start from Electronics Park as soon as FCC construction permits are granted to Transcontinental. First delivery of microwave equipment is expected early in October. Plans call for operation of the communications system from Houston to New York by November 15. The entire installation will be complete by March 1951.

Industrial Supply Opens New Store at Snyder

Industrial Supply Co.'s new Snyder, Tex., store.

A new store at Snyder, Tex., and a new office at Midland, Tex., have been established by the Industrial Supply Co., it was announced recently. The two new outlets increase the total for this concern to 12, located at key points of the Southwest.

W. W. (Bill) Wilson, district representative in the new Midland office, is especially well known to oil men in the Midland area, having been associated with Welex Jet Service, Inc., in this area, the management stated.

The new Industrial Supply store at Snyder is under the management of James Aston, who transfers from another store in this group.

Outlets for the company, following the recent expansion, include offices at Tulsa, Dallas, Houston, San Antonio, and Midland; and stores at Freer, Kamay, Odessa, Electra, Turnertown, Wichita Falls, and Snyder, Tex.

Globe Oil Tools Names New Key Executives

Management of Globe Oil Tools Co. now is in the custody of employes who have been with the company for many years. The new president, and successor to the late E. M. Smith, is Charles E. Whittaker, who also retains his former title of general manager. Whittaker has been with the company ever since it was formed more than 20 years ago and has worked his way up through the ranks, holding such positions as night foreman, machine - shop superintendent, sales manager, and general manager.

C. E. WHITTAKER

T. R. ASHE

D. M. WHIPPLE

J. S. GOODWIN

Succeeding to Whittaker's former position of vice president is Thomas R. Ashe, who also has been elected assistant general manager. Ashe is a 1931 graduate of Notre Dame University. Soon after graduation he became connected with Emsco Derrick & Equipment Co. of Los Angeles, transferring to Globe Oil Tools as advertising manager 4 years later.

Donald M. Whipple retains his post as secretary-treasurer, which position he has held for the past 3 years. Prior to coming to Globe, Whipple was secretary of Diederick Optical Co. of Los Angeles.

John S. Goodwin, a veteran designer of oil-well drilling tools, is head of the Globe engineering department, a position he has held for 10 years. Goodwin holds an M. E. degree from California Institute of Technology, and has been actively engaged in rock bit design since 1938.

Globe recently increased its sales outlets and now has representation at all strategic points in most of the oil-producing states. Lee Wardle, who has been a member of the sales department for the past 15 years, most of that time in the Los Angeles Basin, will supervise sales throughout California.

In addition to its well-known junk catcher and two-cutter rock bit, Globe recently announced a new four-cutter rock bit which is available in most popular sizes for worldwide distribution.

Toben Rejoins Ledeen After Cardwell Service

Alexander Toben, formerly associated with Ledeen Manufacturing Co., Los Angeles, and most recently with Cardwell Manufacturing Co., has rejoined Ledeen.

Toben is to take an active part in the sales and application design of Ledeen hydraulic and pneumatic actuating cylinders, as well as other equipment. Toben graduated with electrical and mechanical engineering degrees from University of Grenoble, France.

Bordelon Promoted by Fluor To Advertising Supervisor

H. J. BORDELON

Promotion of Harold J.Bordelon to the post of advertising supervisor of Fluor Corp., Ltd., has just been announced. He succeeds Jack E. McKay, who has assumed the duties of sales engineer in Fluor's Houston office. Bordelon has been associated with the company for the past 8 years and was formerly assistant advertising manager previously connected with Fluor-o-Scope, the company employe magazine.

(Continued on page 253)

Morrow, Handley Announce New Geophysical Firm

A new firm, Midwestern Geophysical Laboratory, has been announced for Tulsa by M. E. Morrow, president, and E. Jack Handley, executive vice president, both well known in the seismic-exploration and manufacturing business.

Aside from the manufacture and development of geophysical equipment and other industrial instruments, the firm will continue to engage in contract seismic surveys.

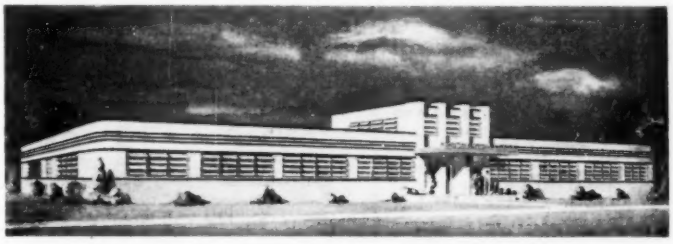
M. E. MORROW

E. J. HANDLEY

Morrow's first undertaking in the geophysical field was with Humble Oil & Refining Co. in the geophysical laboratory in 1930, and in 1935, he came to Tulsa to head the mechanical shops of Carter Oil Co.'s geophysical laboratory. In 1943 he became production manager of the electronic and geophysical section of Engineering Laboratories, Inc. In 1944, Morrow and W. R. Coleman established Coleman Instrument & Manufacturing Co. in Tulsa, and in 1945, Morrow sold his interests to organize Century Manufacturing & Instrument Co. In 1946, Century merged with Continental Geophysical Service, Inc., to form Century Geophysical Corp., of which Morrow was executive vice president, treasurer, director, and principal stockholder.

Handley is a graduate of Oklahoma University. He began his first geophysical work in 1934, and for several years was party chief with Continental Oil Co. In 1943 he became associated with British-American Oil Co. as geophysicist. In 1945 and 1946 he was seismograph supervisor for Shell Oil Co. in the Tulsa area, and later was one of the original incorporators of Century Geophysical.

G. R. Morrow, in charge of manufacturing operations for the new firm, attended Oklahoma A. & M. College and has done postgraduate work at Johns Hopkins University. He was a director and superintendent in charge of manufacturing operations of Century Geophysical.



Architect's drawing of future home of Midwestern Geophysical Laboratory to be constructed at Tulsa. The firm's new laboratory building, to be constructed within the next few months, will occupy a 5-acre tract.

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Your MARKET PLACE FOR THE OIL AND GAS INDUSTRY...

DISPLAY CLASSIFIED
$12.00 a column inch one issue . . .
10% Discount three or more issues.

UNDISPLAYED CLASSIFIED 12c a word one issue. 10% Discount three or more issues. $3.00 minimum charge. Blind Box in our care counts nine words. Payable in Advance.

EQUIPMENT FOR SALE

ONE new 40′ x 40′ x 12′ corrugated aluminum building; double sliding door; single door and window; steel structure. Located: Bunkie, Louisiana. Anchor Gasoline Corp., Phone 54-5201, Tulsa, Oklahoma.

WAR SURPLUS MACHINERY

Gaso, Byron Jackson, Aurora, Wayne Lombard, & Hale Fire Pumps with Engines, 1½ to 25 KW Generator Sets or Light Plants, Engines, Suction Hose, Fire Hose, Victaulic Couplings & Etc. Write for listing. H. A. McCarthy, 310 Thompson Bldg., Phone 5-3296, Tulsa, Oklahoma.

FOR SALE: Model L-107 Allis-Chalmers Fred E. Cooper winch unit for deep well servicing. Excellent condition. Priced to sell. Degen Pipe & Supply Co., Box 107, Red Fork Station, Tulsa, Oklahoma.

FOR SALE—NEW ATTRACTIVELY PRICED

2—30″ Merco Lub. Plug Valves—200# Fig. 1169
3—18″ Merco Lub. Plug Valves—150# Fig. 1169
1—14″ Crane 475½—130# Gate—FF
1—14″ Chapman 600# Gate RTJ
12″ Daniel Orifice Fitting SA—651 w 600 RTJ FGS
8″ Daniel Orifice Fitting SA—169 w 150 RF FGS
(Both complete with meter runs)

Also $86,000 stock new plugs, valves, welding fittings and flanges at our Tulsa warehouse.

GREEN PIPE & SUPPLY CO.
Phone 2-8555, Tulsa, Okla. P.O. Box 1383

EQUIPMENT FOR SALE

FOR CABLE TOOLS
DEGEN PIPE AND SUPPLY CO.
Box 107, Red Fork Station, Tulsa, Oklahoma

REBUILT BOILERS

310 HP. HIENE Water Tube Boiler. Complete with standard trim. Peerless Boiler Company, 421 North Cincinnati, Tulsa; 2015 NE Park Place, Oklahoma City.

FOR SALE: Wilson Mogul drilling rig with portable derrick complete. Suitable for 4500′ depth. Now running in Bebee Field, Pontotoc County, Oklahoma. Contracts available. Lake Oil Company, Ada, Oklahoma.

1 String Complete Rotary Drilling Tools, with Lee C. Moore Heavy Duty Mast, Cardwell Draw Works, 7¼ X 14 Wheland Pump and W.A.K. Waukesha Motor. Tools located near Olney, Illinois. Priced right to sell. Either call 48542 or write H. M. Williams Drilling Company, 701 Bitting Building, Wichita, Kansas.

FOR SALE
NEW—50% TO 75% LESS THAN REPLACEMENT COST
EXPLOSION PROOF

Motors & Controls — Condulets
Flowrators 3″—$60.00 — Telephones—$110.00
Power Weighing Scales — Lights—$35.00
Side Entering Mixers 25HP—$200.00
Vapor Steam Generators—$250.00
Simpson Mixers, Pumps, Valves, Meters, Filters, Gas & Oil Hose.

GENERAL TRADERS, INC.
2675 W. Grand Ave., Chicago 12, Ill.
Phone: AR 6-8050

EQUIPMENT FOR SALE

FOR SALE
(SUBJECT TO PRIOR SALE)

3 Bolted tanks, 2 in original crates and one assembled, (100 Bbl.). 69′-14″ 57# Drive Pipe; 170′-10¾″ 41# Drive Pipe; 407′-10¾″ 32.75# Casing 8Rd. Thd. Smls.; 3045′-8″ 24# Casing 8Rd. Thd. Smls.; 6286′-7″ 23# Casing 8Rd. Thd. Smls.; 8101′-3″ 9.20# Tubing Smls.; 1453′-2⅛″ Tubing EUE Smls.; 14,228′-2″ 6.40# Regular 10Rd. Thd.; 375′-3½″ Pumping rods; 9-8″ Orbit Gate Valves; 9-3″ Orbit Gate Valves; 3-2″ Orbit Gate Valves; 3-2⅞″ x 6″ Parmco Combination Packer; 1-2⅞″ x 6″ Larkin Screw Trip Packer; 1-3″ x 6″ Parmco Packer; 1-2⅞″ x 6″ Gas Anchor Packer. M. B. Belden Office at 425 2nd St. N. W., Canton 2, Ohio, Phone 4-6147.

FOR SALE: 36-L Bucyrus Spudder. A-1 condition. Complete line of drilling tools 15″ down. Sand pumps, swabs, dog house and light plant. New 4000′ lines. No Junk! Located Oklahoma. Box 378, Cherryvale, Kansas.

SEISMOGRAPH EQUIPMENT FOR SALE: Two 2-Ton Chevrolet Coleman 4-Wheel Drive water trucks. 500 gallon tank completely winterized, vacuum fill, Tulsa winch, etc. Excellent condition, low mileage. Original Cost $6600.00 — Sale Price $4000.00.

One ½-Ton Chevrolet crew and field service unit. Bed enclosed with steel, cab with heater, 65 gallon gas tank with gear pump. 7:50 x 15 tires. Low mileage. Original Cost $2800.00—Sale Price $1800.00. Riverside-6811. Dallas, Texas.

FOR SALE—GOVERNMENT SURPLUS

4 & 6 Inch Suction & Discharge Hose, 100 Ton Hydraulic Jacks, Stationary & Marine Diesel Engines & Parts, Light Plants, Large Stock Surplus Items. Industrial & Marine. Contact us before you buy. AL. EPSTEIN, 326 So. Diamond St., Pho. Raymond 5526, New Orleans, La.

Several Army Surplus 4½″ x 6″ Gaso Duplex 1860 Pumps — two piece skid mounted with Chrysler 8 cylinder engines. Will sell pumps only or complete units about half price.

H. H. COFFIELD
ATTN: W. H. Orr
Phones: 132—Rockdale, Texas
A-66064—Houston, Texas

TANKS FOR SALE

8—55,000 bbl. 5 ring, complete shell and bottom only, riveted, 140 tons, plates 6′x20′, rivets backed out, match-marked, loaded on cars, $6500.00 each.

3,000 tons Ring Sheets with rivets backed out, ⅞″ to ½″ included, @ $50.00 per ton, loaded on cars, Tulsa.

P.O. Box 1858 — **W. C. BERRY** — **Tulsa, Oklahoma**

Need PARTS FOR MILITARY TRUCKS?

Send for this **FREE** PARTS AND PRICE LIST

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☐ ***MAIL FREE PARTS AND PRICE LIST TO:***

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We Operate the Following Army Trucks

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ELECTRIC MOTORS

	H.P.	VOLTS	PH.	CYC.
1 West.	15	440	3	60
1 U. S.	25	440	3	60
17 West.	25	440	3	60
7 West.	30	440	3	60
7 West.	40	440	3	60

These motors have been reworked, rewound, and are in good condition.

50% of new price.

For prices and details write:

The Chicago Corporation
P. O. Box 1702
Corpus Christi, Texas

EQUIPMENT FOR SALE

CARDWELL RL SPUDDER. Completely equipped. Good operating condition. Located Central Oklahoma. For prices and terms write: Barnes Drilling Company, 22 West Fourth St., Tulsa, Oklahoma.

1—5″ x 8″ FD-FXX Gardner-Denver Power Pump; 1—5″ x 8″ FD-FXX Gardner-Denver Power Pump mounted on skids with PA-100 International engine. Chapman Pipe & Supply, Box 4232, Oklahoma City, Oklahoma.

FOR SALE: Grinding machines for reclaiming used stainless steel ball valve seats from ¾″ to 2¼″ Ball sizes. Save 75%. Write for details. The Ball Valve Seat Grinder Co., 102 Jamesville Rd., DeWitt, New York (suburb of Syracuse).

FOR SALE
ENGINE LATHE—BRIDGEPORT

30′ Between centers, 31″ swing, 24″ four jaw chuck. Excellent condition. Priced to sell.

ARNOLD HUGHES COMPANY
765 Penobscot Bldg., Detroit, Mich.
WOodward 1-1894

FOR SALE

6,500′ 2½″ Non-Upset 6.40# New Seamless J-55 Range 2 10 Round Thread $45.88 Cft., FOB Pittsburgh, Pa.

1,500′ 13⅜″ OD 54.5# New Electric Weld Double Randoms T&C $3.98 P/Ft. FOB Houston, Texas.

Line Pipe

40,000′ 3½″ OD .130″ to .160″ Wall New Seamless 5.8# T&C 11½ thds. 16′ to 26′ Lengths $37.50 CFT., FOB St. Louis, Mo. Tested to 1,000# pressure.

Other Sizes Line Pipe and Casing Available. For Prices Contact

A. J. STRUBEL
Sidney 1791 **5060 Pernod**
St. Louis, Mo.

100 OCTANE GASOLINE REFINERY

Liquidation Sale!

Inventory Includes

$100,000 in
Tanks, Towers, Vessels.
$100,000 in
Pumps, Turbines, Motors.
$75,000 in
Heat Exchangers, Condensers.
$25,000 in
Laboratory Equipment.
$75,000 in
Instruments and Controls.
$200,000 in
New Refinery Parts and Supplies.
$30,000 in
Stainless Steel Pipe.
Available Immediately

WRITE—WIRE—PHONE

DULIEN STEEL PRODUCTS, INC.
of Washington
P. O. BOX 667
COTTON VALLEY, LA.
PHONE: COTTON VALLEY 26

EQUIPMENT FOR SALE

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The Purchase and
Immediate Dismantling
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STILLS
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P. O. Box 38

EQUIPMENT FOR SALE

USED ROTARY AND CABLE TOOL DRILLING TOOLS. WIRE LINES. E. A. KELLY, BOX 661, OKLAHOMA CITY. PHONE 5-8407.

FOR SALE: 87′ Lee C. Moore Jack-knife derrick, 6′-8″ X 36′ substructure, floor extensions, hand rails, near Corpus Christi, Texas. Price $7,000.00. Falco Drilling Company, Alice, Texas.

FOR SALE: 1—36¡L Bucyrus Rig, 1948 model, complete with all tools. Phone 2032, Henderson, Kentucky.

BOILERS FOR SALE: 18 Code Oil Field Boilers, 50 to 87 H.P., 100 to 200 Lbs. W.P., Operated under Hartford into 1948, not fired since. Located on Leases vicinity Pampa, Texas. Offered subject to prior sale $500.00 to $700.00 Each, as is where is. Contact W. L. Godfrey or Max Harbison, Kewanee Oil Company, Pampa, Texas.

1 BUCYRUS-ERIE 36L Spudder with third leg, A-1 condition, latest model, new lines, ⅞″ & 1⅛″ x 4000′, complete with dog house, light plant, 210 bbl. welded tank on skids, drilling tools, casing outfit, 15½″ to 6″, sills, derrick floors and house, 1948 2½ Ton Dodge Winch Truck, and 3 Ton Dual Wheel Trailer.

1 Bucyrus-Erie 36L Spudder, 1948 Model, A-1 Condition, new lines, ⅞″ & 1⅛″ x 4500′, complete with dog house, light plant, 57′ A-Mast, drilling tools from 15½″ to 5½″, derrick floor and house and all necessary timbers for drilling big hole; 1948 Model ½ Ton Chevrolet Pickup. Russell Drilling Co., Box 572, Russell, Kansas.

FOR SALE: One, type-100 National Drilling Rig has drilled only two wells. With 800,000 pounds capacity jack-knife derrick. Box D-448, The Oil and Gas Journal, Tulsa, Oklahoma.

BARGAIN

4—100 HP Superior Twin Gas Engine COMPRESSORS—now operating in Oklahoma. Alfred B. Kern, 223 Wright Bldg., Tulsa, Oklahoma.

SKID MOUNTED Double Drum Spudder, 6500 foot capacity, double mast with or without tools. Bargain. Box D-457, The Oil and Gas Journal, Tulsa, Oklahoma.

ONE Skid mounted 5 x 10 Gardner Denver Pump with 525 Buda Engine used to drill five shallow holes—$3000.00. Riverside-6811, Dallas, Texas.

40,000′—6⅝″ OD, 17.65#, seamless, range 3, beveled, 80c; 60,000′—6⅝″ OD, 19.79#, T&C, range 1, 80c. All above No. 1 grade. P.O. Box 1858, W. C. Berry, Tulsa, Oklahoma.

EQUIPMENT WANTED

WANTED: 1500 Failing or similar size drill. Truck mounted. Must be complete and ready to drill. Give complete description, price and location. No Junk wanted. Box 378, Cherryvale, Kansas.

WANTED TO BUY OR LEASE: Corrugating Machine. W. C. Berry, P. O. Box 1858, Tulsa, Oklahoma.

INTERESTED in small portable double-mast rig, capable of drilling to approximately 2000 feet, with or without drill pipe. Equipment must be in good condition and reasonably priced. Preferably located in Southwest Texas. Contact:

MAKIN DRILLING COMPANY
Box 131, Hobbs, New Mexico, Phone 131

WANTED

Hyster Winches Towing or Worm Drive Models D8N — D7N — D6N and D4N.

JOHN FABICK TRACTOR COMPANY
3100 Gravois, St. Louis, 18, Mo.
Phone: Laclede 8900. L.D. 5

LEGAL BLANKS

BURKHART LEGAL BLANKS since 1908 Oil-Gas (all states), Business, Real Estate Legal Forms, Leases, Revised With Government Regulations, Commercial Printing. Catalog and Samples on request. Burkhart Printing & Stationery Company, 115 South Cincinnati, Tulsa 3, Oklahoma.

HELP WANTED

FOREIGN and Domestic Oil Employment Directory (including late supplement of oil companies and drilling contractors in Western Canada). Over 500 listings in drilling, production, refinery, natural gasoline, pipelines, geological, exploration, supplies, manufacturers, services and refinery and pipeline contractors, showing where to apply for jobs. Price $5.00. Oil Industry Mailing List, Box 2603, Tulsa, Okla. (Our 30th year)

ENGINEERS, Executives, Technical Men Salaried positions — $3600 to $30,000. This confidential service for outstanding men who desire a change of connection, will develop and conduct preliminary negotiations without risk to present position. Send name and address for details. Tomsett Associates, 1204 Berger Bldg., Pittsburgh 19, Pa.

WANTED: Man located in West Texas to handle technical specialities, on commission, such as control valves, steam traps, etc., under well known organization with main offices and warehouse in Houston. Prefer man already established but desires to extend his activity. Box D-469, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED! Salesmen in essential areas to call on production superintendents. Write for particulars. The Ball Valve Seat Grinder Co., 102 Jamesville Road, DeWitt, New York (Suburb of Syracuse).

INSTRUMENT ENGINEER

Graduate Engineer with several years' experience in the selection of automatic control instruments for petroleum processing plants, required by engineering and construction company operating internationally. Initially for service in New York Office.

Box D-463, The Oil and Gas Journal, Tulsa, Okla.

ESTIMATOR

Experienced ENGINEER familiar with Oil Refinery design and capable of estimating process equipment from flow diagrams.

Give full information, experience record and salary expected.

ARTHUR G. McKEE & CO.

2300 CHESTER AVE.
CLEVELAND 1, OHIO

SITUATIONS WANTED

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No. 131, Ph. No. 131, Hobbs, New Mexico.

TWENTY YEARS' EXPERIENCE compressor station, gasoline plant and field construction, operation and management. Desire project management position. Have had production experience. Presently employed. Box D-461, The Oil and Gas Journal, Tulsa, Oklahoma.

PHOTOGRAPHER, sixteen years' experience, photomicrography, technical and scientific work exclusively, wants position in oil research laboratory, southwest preferred. Box D-468, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION and Drilling Supervisor: Desires immediate change. 8 years with major, Illinois basing drilling, completion, production, and equipment; 1 year oil field construction. Graduate Petroleum Engineer. Age 31, family. Box D-467, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL ENGINEER: Fifteen years design, construction, and maintenance experience in absorption, chemical, and refining plants. Ten years supervisory capacity. Prefer Okla. or Texas. Reply Box 287, Winnie, Tex.

SITUATIONS WANTED

GRADUATE CHEMIST: 10 years experience in soap products, synthetic rubber, quality control, supervision. Write: Box D-465, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL ENGINEER, 3 years diversified engineering, 2½ years intensive production training with major, desires affiliation with progressive independent operating in mid-continent or Louisiana area. MS degree, married, and now employed. Box D-470, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

TEST started on large promising structure, Montana. Geological data favorable. Will dispose of an interest in leases. Box D-466, The Oil and Gas Jouranl, Tulsa, Oklahoma.

1916 A. OIL LEASE for $1900 in S. W. Wyoming, near Highway 30, on Piedmont cross structure of Meridian Anticline. Good Geology. R. O. Barnsley, 950 Lincoln Ave., Palo Alto, Calif.

HAVE SMALL LEASE on same structural high as recent great Oriskany Strike in North Central Pennsylvania. Asking ⅛ override. Box D-471, The Oil and Gas Journal, Tulsa, Oklahoma.

IF you've got real oil proposition or royalty that you wish to sell, or any defaulted municipal or special assessment bonds, bring your deal to me. Dyer-OJ, 1835 Champa, Denver, Colorado.

ACREAGE for drilling in Southeast Kansas, on farm out basis, by Geophysical Geologist, references. Address: Mr. Fackler, 3644 Wyandotte, Kansas City, Mo.

8,000 Acres Van Buren County, Arkansas. Anyone interested in good block for development on plant anticline write or wire W. S. Stephenson, Clinton, Arkansas.

FOR SALE: Oil and Gas Leases and drilling propositions in shallow territory of Allen, Simpson, and Warren Counties, Kentucky. W. P. Harley, Bowling Green, Kentucky

LEASES ROYALTIES

Producing and Nonproducing
Bought and Sold—Any Area
Inquiries Invited

B. D. BUCKLEY
6376 Clayton Road, St. Louis 17, Mo.

REEF TREND DRILLING BLOCK

Have large drilling block North of Scurry and Kent Counties in the Canyon reef trend. Very reasonable drilling deal offered to reliable operator financially able to drill deep test.

P.O. BOX 1032
LUBBOCK, TEXAS

North Dakota Minerals and Leases

Bought direct for you on your purchase order. Our lease block map and reprint of press and magazine articles clearly outlining this play mailed on request.

(Purchase orders accepted only from those connected with the oil industry or royalty business).

Wire, Write or Call

JOHN ALLEN or BILL McBIRNEY
Suite 200, Grand Pacific Hotel
Bismarck, North Dakota

(Member National Oil Scouts and Landmen Association. References exchanged).

LEASE AND DRILLING BLOCKS

OIL AND GAS LAND FOR LEASE!!

WE HOLD 3,800 acres of Government & State leased lands, some of it close to producing areas in Carbon and Sweetwater Counties. Will sell some of our royalty. L. J. Lincecum & Associates, 817 West Pine Street, Rawlins, Wyoming.

ROYALTIES

DEEDED ROYALTIES

San Juan Basin & Permian Basin. Write Harry S. Wright, Wright Bldg., Farmington New Mexico.

MONTANA ROYALTIES

Millions of acres now leased by world's major companies, with huge drilling play in prospect. For booklet describing Montana geology and oil development, write Landowners Royalty Company, Box 1225 Great Falls, Montana.

WESTERN NEBRASKA

Oil, gas royalty in proven Cheyenne County or nearby wildcat. Write, wire, phone. Smith-Enders Land Co., Kimball, Nebraska.

WE will buy producing or non-producing oil royalties. Standard Security Company, 115 Broadway, New York 6.

¼ ROYALTY in 2280 acres Southern LeFlore County at $1.00 an acre. Z. J. Harrison, Poteau, Oklahoma.

FOR LEASE

ATTRACTIVE office space to lease in new oil building in Key West Texas oil city—Abilene, Texas. Ready for occupancy on or about Sept. 1st. Fire-Proof, Year around air-conditioning, janitorial service and parking space adjacent to building. Modern selected office arrangements. Contact Jimmy Partin, Tel. 8561, Abilene, Texas.

WANTED

WANTED: SURPLUS Chemicals, Oils, Waxes, Solvents, Wastes and Residues of all kinds. Chemical Service Corporation, 98-06 Beaver St., New York 5, N. Y.

PATENT ATTORNEYS

PATENT Practice before U. S. Patent Office. Validity and Infringement Investigations and Opinions. Booklet and form "Evidence of Conception" forwarded upon request. Lancaster, Allwine & Rommell, Registered Patent Attorneys, Suite 418, 815-15th Street, N.W., Washington 5, D. C

FOR SALE

FOR SALE

Executive five-passenger twin-engine Lockheed 12-A, formerly owned by major oil company. Recent major engine and frame overhaul; Latest VHF radio, new automatic radio compass; Auxiliary tanks; New full-feathering hydromatic propellors. Priced very reasonably. Box D-459, The Oil and Gas Journal, Tulsa, Oklahoma.

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EQUIPMENT MEN

(Continued from page 249)

Trexel Joins International Marine Platform Firm

Rear Adm. Carl A. Trexel, Civil Engineer Corps, USN, has retired at his own request after 33 years in the Navy to take a position as executive manager, International Marine Platform Constructors, of San Francisco. Admiral Trexel attained the rank of rear admiral in August 1944, when he was assigned as director of the Alaskan Division, Bureau of Yards and Docks. His most recent duty was as director of the Pacific and Alaskan divisions with headquarters in San Francisco.

International Marine Platform Constructors, which Trexel is joining, is a joint venture organized by Ben C. Gerwick, Inc., San Francisco, and Stolte, Inc., Oakland, heavy marine and general contractors, to construct offshore marine platforms for oil drilling and other purposes.

Trimble Goes to West Texas For A-1 Bit & Tool

Harry C. Trimble has established headquarters at Midland, Tex., to direct sales and service of A-1 Bit & Tool Co. products.

A former driller in Kansas, Oklahoma, and Mississippi, Trimble joined A-1 Bit & Tool as a service tool operator in 1946, and has since that time successfully held positions as district sales manager in Houma, La., Brookhaven, Miss., and Calgary, Canada.

Western Starts New Flight To Edmonton, Canada

Western Air Lines, Inc., has announced it will inaugurate through service between Denver and Edmonton, Alta., Canada, on April 30, cutting 3 hours, 15 minutes off current schedules between these two points.

John Ruddy, district sales manager for Western's inland division here, said a new daily flight will depart Denver at 2:40 p.m. and arrive at Edmonton at 11:05 p.m. Total elapsed time, including ground time for customs clearances at the U. S.-Canadian border and en route stops at Casper, Wyo., Billings, Great Falls and Cut Bank, Mont., and Lethbridge, Canada, will be 8 hours, 25 minutes.

Ruddy said Western's Oil Scout flight will continue to operate with the Denver departure time set at 8 a.m. daily. The Oil Scout will terminate at Lethbridge where direct connections with Trans-Canada Airlines can be made to Calgary and Edmonton.

Denning Made Supervisor of Mid-Continent Area

United Geophysical Co., Inc., has announced the appointment of Wayne H. Denning as area supervisor in the Mid-Continent area with headquarters in Tulsa.

Denning is a graduate of Colorado School of Mines. He joined United in 1938 after 12 years as geologist and geophysicist for Stanolind Oil & Gas Co.

In 1946 Denning returned to the United States after 6 years as United's supervisor of Brazilian operations with headquarters in Rio de Janeiro. Since that time he has supervised United's operations in Puerto Rico and has just recently been area supervisor for California, Wyoming, and West Texas, with headquarters in Pasadena.

CALENDAR OF EVENTS

May

American Petroleum Institute, Division of Refining, midyear meeting, Hotel Cleveland, Cleveland, May 1-4.

Interstate Oil Compact Commission spring meeting, Biloxi, Miss., May 4-6.

National Stripper Well Association, Biltmore Hotel, Los Angeles, May 7-9.

Independent Petroleum Association of America, midyear meeting, Biltmore Hotel Los Angeles, May 7-9.

American Gas Association, Natural Gas Department, spring meeting, Mayo Hotel Tulsa, May 8-9.

Liquefied Petroleum Gas Association, annual convention, Palmer House, Chicago May 8-11.

American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles, May 11-12.

American Petroleum Institute, central committees on accident and fire prevention, midyear meeting, Atlantic City, N. J., May 15-18.

American Gas Association, production and chemical conference, Hotel New Yorker New York, May 22-24.

American Institute of Chemical Engineers, regional meeting, New Ocean House, Swampscott, Mass., May 28-31.

Gas Technology Short Course, Texas College of Arts and Industries, Kingsville Tex., May 29-31.

June

National Oil Scouts and Landmen's Association, Skirvin Tower Hotel, Oklahoma City, June 8-10.

American Society of Mechanical Engineers, oil and gas power division, Lord Baltimore Hotel, Baltimore, June 12-16.

Pennsylvania Grade Crude Oil Association, Hotel William Penn, Pittsburgh, Pa June 15-16.

Petroleum Equipment Suppliers Association, annual membership meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., June 18-20.

American Society of Mechanical Engineers, Hotel Statler, St. Louis, June 19-23.

Canadian Gas Association, annual convention, Manoir Richelieu Hotel, Murray Bay, Quebec, June 19-24.

Kentucky Oil and Gas Association, annual meeting, Lexington, Ky., June 22-23.

American Society for Testing Materials annual meeting Chalfonte-Haddon Hall, Atlantic City, N. J., June 26-30.

American Petroleum Institute, midyear division of production and standardization conference, Brown Palace Hotel, Denver, June 26-30.

July

Institute of Petroleum, oil shale and cannel coal conference, Glasgow, Scotland, July 3-7.

August

Interstate Oil Compact Commission, summer meeting, French Lick, Ind., August 3-5.

September

National Chemical Exposition, Chicago Coliseum, Chicago, September 5-9.

American Society of Mechanical Engineers and Instrument Society of America Municipal Auditorium, Buffalo, N. Y., September 11-15.

National Petroleum Association, Hotel Traymore, Atlantic City, N. J., September 13-15.

American Society of Mechanical Engineers, petroleum mechanical engineering conference, Roosevelt Hotel, New Orleans September 25-27.

Instrument Society of America, annual instrument conference and exhibit, Memorial Auditorium, Buffalo, N. Y., September 18-22.

October

American Gas Association, annual convention, Atlantic City, N. J., October 2-6.

Mid-Continent Oil and Gas Association, Texas division, Dallas, October 4-5.

Petroleum Branch, American Institute of Mining and Metallurgical Engineers, Mid-Continent meeting, Roosevelt Hotel, New Orleans, October 4-6.

American Association of Oilwell Drilling Contractors, annual meeting Mayo Hotel Tulsa, October 9-10.

Petroleum Branch, American Institute of Mining and Metallurgical Engineers, West Coast meeting, Elks Club, Los Angeles, October 12-13.

November

Mid-Continent Oil and Gas Association, Louisiana-Arkansas Division, annual meeting, Roosevelt Hotel, New Orleans, November 2-3.

American Petroleum Institute, annual meeting, Biltmore and Ambassador Hotels, Los Angeles, November 13-16.

American Society of Mechanical Engineers, Hotel Statler, New York, November 26-December 1.

December

American Institute of Chemical Engineers, annual meeting, Columbus, Ohio, December 3-6.

NOMADS

Tulsa Nomads, third Friday of each month. After Five Room, Tulsa Hotel.

Dallas-Fort Worth Nomads, first Monday of each month, Greater Dallas Club.

Houston Nomads, second Monday of each month, Ye Ole College Inn, Houston.

Los Angeles Nomads, second Wednesday of each month, Jonathan Club.

New York Nomads: May 10, annual invitation dinner, Louis Sherry's, and June 13-15, golf party, Westchester.

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Indiana

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Gibson County: Ashland-Buchman-O'Neal 1 V. Saylor et al., NW NE NW 16-2s-11w, dry, TD 2,389 ft.

Knox County: W. C. Vickery 1 McLin, SE SE SE 33-1n-12w, dry, TD 2,355 ft.

Vanderburgh County: C. E. Skiles 1 Knighton, SE SE NE 25-5s-11w, dry, TD 2,111 ft.

EASTERN KENTUCKY

ASHLAND.—Location has been made for an important deep test in the eastern part of the state. It is A. H. Carpenter 1 J. W. Whitt in 13-W-78, town of Deevert, Carter County. The test is approximately 3½ miles southeast of the same operator's recently completed 1 Virgil Ramey which, although plugged as a dry hole, had good oil shows in the St. Peter sand at 3,590-3,606 ft. The well is expected to check part of the upper Knox dolomite sequence as well as the St. Peter sand.

EASTERN KENTUCKY WILDCAT FAILURE

Lewis County: H. P. Purnell et al 1 C. F. Ferguson 4-Y-72, dry, TD 1,545 ft., Tyrone lime 985 ft.

WESTERN KENTUCKY WILDCAT FAILURES

Daviess County: C. H. Nichols 1 Burns Heirs, NE NW NW 18-O-29, dry, TD 2,051 ft.

Union County: Delta Drilling Co. 1 Ed Gough, SW SW NW 9-O-19, dry, TD 2,807 ft.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D.C. Notice is hereby given that two units of land containing in all 400 acres in Ts. 29 and 30 N., R. 113 W., 6th P.M., Wyoming, within the known geologic structure of the Big Piney field, will be offered for oil and gas leasing, through competitive bidding, at 1 p. m. on May 17, 1950, when bids will be open. The details of the lease offering, how and where to file bids, and a description of the lands may be obtained by addressing an inquiry to the Manager of the Land and Survey Office, Cheyenne, Wyoming, or to this office. Marion Clawson, Director.

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Legend portrays Kent Morgan as man, minstrel, and myth, a giant through the early days of the oil industry . . . fantastic wildcatter and prospector . . . hero of a thousand tales told and retold around drilling rigs.

Kent Morgan's Record Gusher

Among the more fabulous legends that are repeated on oil rigs, even today when deep-hole drilling records are mentioned, is the story of Kent Morgan's depth-shattering gusher.

Tired of shallow drilling, Morgan decided to drill deep into the earth for greater production. Since such a venture was unprecedented, the colossus of the oil fields wasn't so sure how far he would have to drill; so he contrived a mighty rig and set to work on a round-the-clock shift. He passed all the then-known formations and set new depth records by the hour. Finally, on the fortieth day of drilling, the rig shook violently — rumblings and strange noises issued from the hole — then, with a mighty roar the sky was darkened with oil and strange objects . . . Morgan had hit — and what a gusher it was! His drill stem had struck oil sands just beneath the city of Hong Kong, and for miles around his rig the terrain was covered with crude and coolies! A record well? Indeed, for with Kent Morgan only the impossible was desirable!

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